

Wisconsin
Chapter HFS 157- Radiation Protection
Regulatory Guide

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Guidance for Portable Gauges or XRF Devices

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Radiation Protection Section
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PPH 45025 (01/04)

EXECUTIVE SUMMARY

Wisconsin Regulatory Guides (WISREGS) are issued to describe and make available to the public acceptable methods of implementing specific parts of **Wisconsin Administrative Code, Chapter HFS 157 ‘Radiation Protection,’** to delineate techniques used by the staff in evaluating past specific problems or postulated accidents, and to provide guidance to applicants, licensees, or registrants. WISREGS are not substitutes for **Chapter HFS 157 ‘Radiation Protection,’** therefore compliance with them is not required. Methods and solutions different from those set forth in this guide will be acceptable if they provide a basis for the Department of Health and Family Services (DHFS), Radiation Protection Section to determine if a radiation protection program meets the current rule and protects public health and safety.

Comments and suggestions for improvements in this WISREG are encouraged. This WISREG will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Comments should be sent to **Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison, WI 53701-2659.**

Requests for single copies of this guide (which may be reproduced) can be made in writing to **Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison, WI 53701-2659**

This WISREG “Guidance for Portable Gauges or XRF Devices” has been developed to streamline the application process for a Portable Gauge or XRF License. A copy of the application DPH 45006 “*Application for Radioactive Material License Authorizing the use of Sealed Sources in Portable Gauges Or XRF Devices*” is located in **Appendix A** of this guide.

Appendix A through K provides examples, models and additional information that can be used when completing the application.

It typically takes 60-90 days for a license to be processed and issued if the application is complete. When submitting the application be sure to Include the appropriate application fee listed in **HFS 157.10** for either a Portable Gauge or an XRF Device.

In summary, the applicant will need to do the following to submit an application for a Portable Gauge or XRF Device license.

- Use this regulatory guide to prepare the application DPH 45006 '*Application for Radioactive Material License Authorizing the use of Sealed Sources in Portable Gauges Or XRF Devices*'
- Complete the application DPH 45006 (**Appendix A**). See 'Contents of Application' of the guide for additional information.
- Include any additional attachments.
 - All supplemental pages should be typed on a 8 ½" x 11" paper.
 - Please identify all attachments with the applicant's name and license number (if a renewal).
- Avoid submitting proprietary information unless it is absolutely necessary.
- Submit an original signed application along with attachments (if applicable) and if possible a copy on a diskette or CD (Microsoft Word is preferred).
- Submit the application fee.
- Retain one copy of the licensee application and attachments (if applicable) for your future reference.

You will need this information because the license will require that radioactive material be possessed and used in accordance with statements, representation, and procedures provided in the application and supporting documentation.

If you have any questions about the application process please contact DHFS, Radiation Protection Section at (608) 267-4797.

CONTENTS

Executive Summary	2
Contents.....	4
List of Appendices	5
List of Tables.....	5
List of Figures	6
Abbreviations	6
Purpose of Report	7
Who Regulates at Federal Facilities in Wisconsin?	9
Management Responsibility	11
Applicable Rule	12
How to File	
Paper Application	13
Where to File	14
License Fees	15
Contents of an Application	16
Item 1: License Action Type	16
Item 2: Applicant's Name and Mailing Address	16
Item 3: Person to Be Contacted About this Application	18
Item 4: Address(es) Where Licensed Material Will be Used or Possessed	18
Radiation Safety Officer and Authorized Users	
Item 5: Individual(s) Responsible for Radiation Safety Program and Their Training and Experience – Radiation Safety Officer (RSO).....	20
Item 6: Training for Individuals Working in or Frequenting Restricted Areas	22
Radioactive Material	
Item 7: Radioactive Material	
Item 7.1: Radioactive Material – Sealed Sources and Devices and Purpose(s) for Which Licensed Material Will be Used.....	23
Item 7.2: Radioactive Material – Financial Assurance and Record Keeping For Decommissioning	25
Item 8: Facilities and Equipment	26
Radiation Safety Program	
Item 9: Radiation Safety Program	
Item 9.1: Audit Program.....	27
Item 9.2: Termination of Activities	28
Item 9.3: Instruments.....	29
Item 9.4: Material Receipt and Accountability	30
Item 9.5: Occupational Dosimetry	32
Item 9.6: Public Dose.....	33
Item 9.7: Operating and Emergency Procedures.....	35
Item 9.8: Leak Tests.....	39
Item 9.9: Maintenance.....	40
Item 9.10: Transportation.....	42
Item 9.11: Waste Management – Gauge Disposal and Transfer	44
Fees and Certification	
Item 10: Fees	45
Item 11: Certification.....	45

LIST OF APPENDICES

Appendix A:	DPH 45006 ‘Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges or XRF Devices’	47
Appendix B:	Sample XRF Certification Statement	49
Appendix C:	Information Needed for Change of Ownership or Control Application	51
Appendix D:	Criteria for Acceptable Training Courses for Portable Gauge or XRF Users	55
Appendix E:	Typical Duties and Responsibilities of the Radiation Safety Officer	59
Appendix F:	Portable Gauge or XRF Audit Checklist	61
Appendix G:	Information Needed to Support a Portable Gauge Licensee’s Request to Perform Non-routine Maintenance.....	67
Appendix H:	Operating and Emergency Procedures	70
Appendix I:	Dosimetry-related Guidance	
	<i>Part 1: Worksheet for Determining if Personnel Dosimetry is required for XRF Users</i>	<i>75</i>
	<i>Part 2: Guidance for Demonstrating that Individual Members of the Public will not Receive Doses Exceeding the Allowable Limit</i>	<i>78</i>
Appendix J:	Requests to Perform Leak Testing and Sample Analysis	88
Appendix K:	Major DOT Regulations; Sample Bill of Lading	91
Appendix L:	DPH 45007 ‘Certificate of Disposition of Materials’	100

LIST OF TABLES

Table 1	Who Regulates the Activity?.....	9
Table 2	Information Known About Each Gauge.....	81
Table 3	Calculational Method, Part 1 Hourly and Annual Dose Received from Gauge 1	82
Table 4	Calculational Method, Part 1 Hourly and Annual Dose Received from Gauge 2	82
Table 5	Calculational Method, Part 1 Hourly and Annual Dose Received from Gauge 3	83
Table 6	Calculational Method, Part 1 Total Hourly and Annual Dose Received from Gauges 1, 2, and 3	83
Table 7	Calculational Method, Part 2 Annual Dose Received from Gauges 1, 2, and 3	84
Table 8	Calculational Method, Part 3 Summary of Information.....	84
Table 9	Calculational Method, Part 3 Annual Dose Received from Gauges 1, 2, and 3	85
Table 10	Combination Measurement-Calculational Method	87

LIST OF FIGURES

Figure 1.	Where is the Radioactive Source?.....	7
Figure 2.	U.S. Map.	10
Figure 3.	RSO Responsibilities.....	21
Figure 4.	Material Receipt and Accountability.....	31
Figure 5.	Annual Dose Limits for Radiation Workers.	32
Figure 6.	Storing Gauges.	34
Figure 7.	Proper Handling.	37
Figure 8.	Security.....	38
Figure 9.	Maintenance.	41
Figure 10.	Transportation.	43
Figure 11.	Diagram of Office and Gauge Storage Area.	81

ABBREVIATIONS

ALARA	As low as reasonably achievable
Bq	Becquerel
DHFS	Department of Health and Family Services (State of Wisconsin)
DOE	United States Department of Energy
DOT	United States Department of Transportation
GPO	Government Printing Office
IN	Information Notice
mrem	millirem
mSv	millisievert
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OSL	Optical Stimulated Luminescent Dosimeters
RQ	Reportable Quantities
RSO	Radiation Safety Officer
SS&D	Sealed Source and Devices Bulletin Board System (BBS)
SSD	Sealed Source and Device
Sv	Sievert
TEDE	Total effective dose equivalent
TI	Transportation Index
TLD	Thermoluminescent dosimeters
XRF	X-ray Fluorescence Analyzer

PURPOSE OF GUIDE

This document provides guidance to an applicant in preparing a portable gauge or X-Ray Fluorescence Analyzer (XRF) license application as well as the Department of Health and Family Services (DHFS) Radiation Protection Section criteria for evaluating a portable gauge license application. It is not intended to address the research and development of gauging devices or the commercial aspects of manufacturing, distribution, and service of such devices. Within this document, the phrases, "portable gauge," "gauging devices," or "XRF" and the term "gauge" may be used interchangeably.

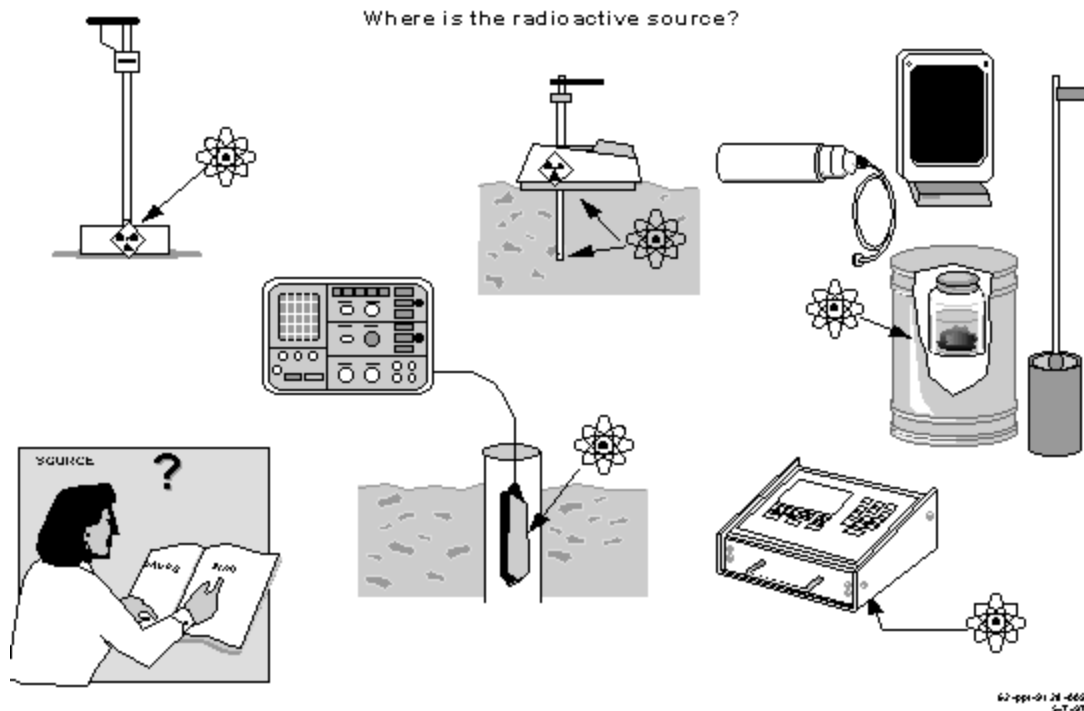


Figure 1. Where is the Radioactive Source? The wide variety of portable gauge designs include placing the sealed source in different locations, resulting in different radiation safety problems.

This document addresses the variety of radiation safety issues associated with portable gauges and XRFs of many designs. As shown in **Figure 1**, portable gauges are of many different designs based, in part, on their intended use (e.g., to measure moisture, density, thickness of asphalt, liquid level). Because of differences in design, manufacturers provide appropriate instructions and recommendations for proper operation and maintenance. In addition, with gauges and XRFs of varying designs, the sealed sources may be oriented in different locations within the devices, resulting in different radiation safety problems.

This report identifies information needed to complete form DPH 45006 (**Appendix A**), ‘*Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges Or XRF Devices.*’

The format within this document for each item of technical information is as follows:

- **Rule**--references the regulations(s) applicable to the item;
- **Criteria**--outlines the criteria used to judge the adequacy of the applicant's response;
- **Discussion**--provides additional information on the topic sufficient to meet the needs of most readers; and
- **Response from Applicant**--provides suggested response(s), offers the option of an alternative reply, or indicates that no response is needed on that topic during the licensing process.

The information submitted in the application must be sufficient to demonstrate that proposed equipment, facilities, personnel, and procedures are adequate to protect the health and safety of the citizens of Wisconsin according to DHFS's guidelines. Submission of incomplete or inadequate information will result in delays in the approval process for the license. Additional information will be requested when necessary to ensure that an adequate radiation safety program has been established. Such requests for additional information will be requested when necessary. Such requests for additional information will delay completion of the application's review and may be avoided by a thorough study of the rule(s) and these instructions prior to submitting the application.

WHO REGULATES AT FEDERAL FACILITIES IN WISCONSIN?

In the special situation of work at federally-controlled sites in Wisconsin, it is necessary to know the jurisdictional status of the land to determine whether Nuclear Regulatory Commission (NRC) or DHFS has regulatory authority. NRC has regulatory authority over land determined to be under “exclusive federal jurisdiction,” while DHFS has jurisdiction over non-exclusive federal jurisdiction land (see **Table 1**). Applicants and licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. DHFS recommends that applicants and licensees ask their local contacts for the federal agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with NRC or DHFS regulatory requirements, as appropriate.

Table 1. Who Regulates the Activity?

Applicant and Proposed Location of Work	Regulatory Agency
Federal agency regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [10 CFR 30.12])	NRC
Non-federal entity in non-Agreement State (see map on next page), U.S. territory, or possession	NRC
Non-federal entity in WI at non-federally controlled site	DHFS
Non-federal entity in WI at federally-controlled site <i>not</i> subject to exclusive Federal jurisdiction	DHFS
Non-federal entity in WI at federally-controlled site subject to exclusive federal jurisdiction	NRC

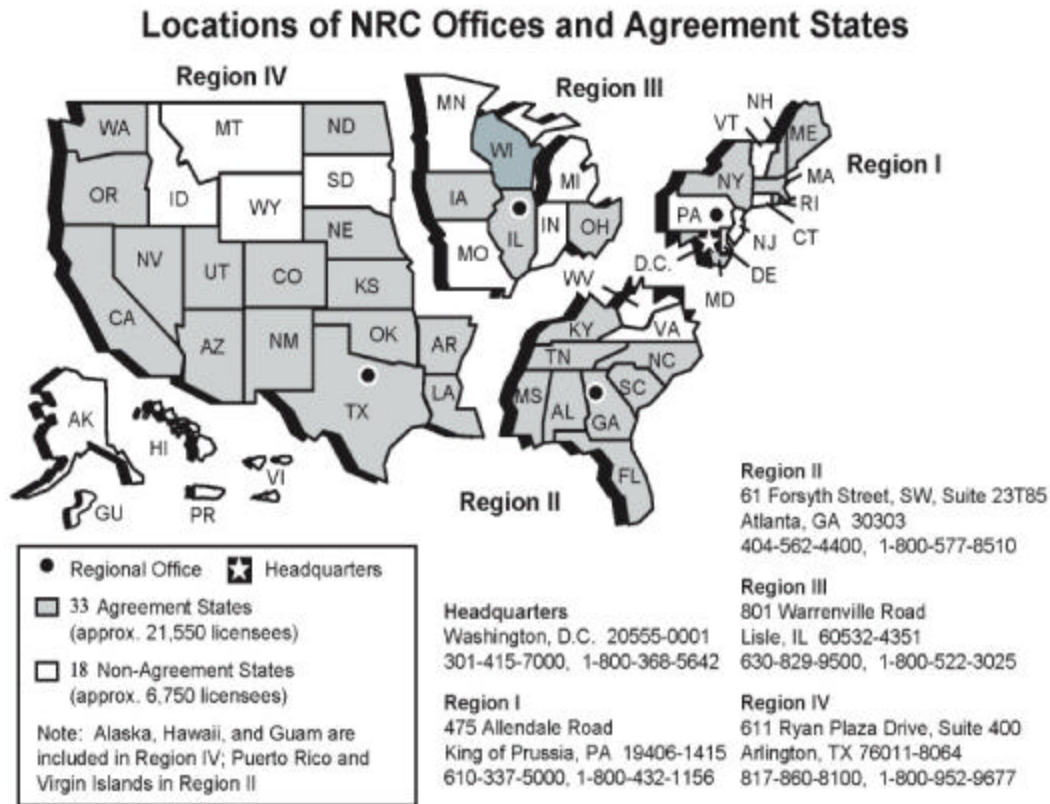


Figure 2. *U.S. Map. Location of NRC Offices and Agreement States.*

Reference: A current list of Agreement States (States that have entered into agreements with the NRC that give them the authority to license and inspect radioactive material used or possessed within their borders), (including names, addresses, and telephone numbers of responsible officials) may be obtained upon request from NRC's Regional Offices. NRC Office of State and Tribal Programs (STP) also provides the current list of Agreement States which can be found at <http://www.hsr.gov/NRC>.

MANAGEMENT RESPONSIBILITY

DHFS recognizes that effective radiation safety program management is vital to achieving safe and compliant operations. DHFS also believes that consistent compliance with **Chapter HFS 157 ‘Radiation Protection’** provides reasonable assurance that licensed activities will be conducted safely. Through its experience, DHFS has found that effective management has been shown to be key to a well-run radiation safety program. Management refers to a senior-level manager who has responsibility for overseeing licensed activities.

To ensure adequate management involvement, a management representative must sign the submitted application acknowledging management’s commitments and responsibility for all the following:

- Radiation safety, security and control of radioactive materials, and compliance with **Chapter HFS 157 ‘Radiation Protection’**;
- Completeness and accuracy of the radiation safety records and all information provided to DHFS;
- Knowledge about the contents of the license and application;
- Committing adequate resources (including space, equipment, personnel, time and if needed, contractors) to the radiation protection program to ensure that public and worker safety is protected from radiation hazards and compliance with the rule is maintained; and
- Selecting and assigning a qualified individual to serve as the Radiation Safety Officer (RSO) for their licensed activities.

APPLICABLE SUBCHAPTERS

It is the applicant's or licensee's responsibility to obtain read and follow **Chapter HFS 157 'Radiation Protection'**.

The following subchapters of **Chapter HFS 157 'Radiation Protection'** contain regulations applicable to Portable Gauge Devices or XRFs.

- Subchapter I: 'General Provisions';
- Subchapter II: 'Licensing of Radioactive Materials';
- Subchapter III: 'Standards for Protection from Radiation';
- Subchapter X: 'Notices, Instructions and Reports to Workers';
- Subchapter XI: 'Inspection by the Department';
- Subchapter XII: 'Enforcement'; and
- Subchapter XIII: 'Transportation'.

To request copies of the above documents, call Department of Health and Family Services (DHFS), Radiation Protection Section **at (608) 267-4797 or for electronic copy go to our web site at:**
http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/IndexRM.htm.

HOW TO FILE

PAPER APPLICATION

Applicants for a materials license should do the following:

- Be sure to use the current guidance from DHFS in preparing an application.
- Complete DPH 45006 '*Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges Or XRF Device*'. (**Appendix A**).
- For each separate sheet, other than submitted with the application, identify and key it to the item number on the application, or the topic to which it refers.
- Submit all documents on 8 ½ x 11 inch paper.
- Avoid submitting proprietary information unless it is absolutely necessary.
- Submit an original, signed application.
- Retain one copy of the license application for your future reference.

Deviations from the suggested wording of responses as shown in this document or submission of alternative procedures may require a custom review.

Personal employee information, i.e., home address, home telephone number, Social Security Number, date of birth, and radiation dose information, should not be submitted unless specifically requested by DHFS.

WHERE TO FILE

Applicants wishing to possess or use radioactive material in Wisconsin are subject to the requirements of **Wisconsin Administrative Code Chapter HFS 157 ‘Radiation Protection’** and must file a license application with:

*Department of Health and Family Services
Radiation Protection Section
P.O. Box 2659
Madison, WI 53701-2659*

LICENSE FEES

The appropriate fee must accompany each application or license amendment request. Refer to ***HFS 157.10*** to determine the amount of the fee. DHFS will not issue the new license prior to fee receipt. Once technical review has begun, no fees will be refunded. Application fees will be charged regardless of DHFS' disposition of an application or the withdrawal of an application.

Licensees are also subject to annual fees; refer to ***HFS 157.10***.

Direct all questions about DHFS' fees or completion of **Item 10** of DPH 45006 '*Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges Or XRF Device*' (**Appendix A**) to the Department of Health and Family Services, Radiation Protection Section at (608) 267-4797.

CONTENTS OF AN APPLICATION

Item 1: License Action Type

On the application check the appropriate box and list the license number for renewal and amendments.

Response from Applicant:

Item 1 Type of Application (Check one)

☐ New License ☐ Renewal License Number ☐ Amendment License Number

Item 2: Applicant's Name and Mailing Address

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material; a division or department within a legal entity may not be a licensee. An individual may be designated, as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent. A Post Office box number is an acceptable mailing address.

Notify DHFS of changes in the mailing address.

Note: DHFS must be notified in the event of change of ownership or control and bankruptcy proceedings; see below for more details.

Response from Applicant:

Item 2 Applicant - Name and Mailing Address
Applicant - Telephone Number (Include area code)

Timely Notification of Change of Ownership or Control:

Rule: *HFS 157.13(10)*

Criteria: Licensees must provide full information and obtain DHFS's **written consent prior** to transferring ownership or control of the license, or, as some licensees call it, "transferring the license."

Discussion: Changes in ownership may be the results of mergers, buyouts, or majority stock transfers. Although it is not DHFS's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior DHFS written consent. This is to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid DHFS licenses;
- Materials are properly handled and secured;
- Persons using these materials are competent and committed to implementing appropriate radiological controls;
- A clear chain of custody is established to identify who is responsible for final disposal of gauge or XRF; and
- Public health and safety are not compromised by the use of such materials.

Appendix C identifies the information to be provided about changes of ownership or control.

Notification of Bankruptcy Proceedings

Rule: *HFS 157.13(10)*

Criteria: Within 10 days following filing of voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify DHFS in writing, identifying the bankruptcy court in which the petition was filed and the date of filing.

Discussion: Even though a licensee may have filed for bankruptcy, the licensee remains responsible for all regulatory requirements. DHFS needs to know when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled, and

whether there are any public health and safety concerns (e.g.; contaminated facility). DHFS shares the results of its determinations with other involved entities (e.g.; trustees), so that health and safety issues can be resolved before bankruptcy actions are completed.

Item 3: Person To Be Contacted About This Application

Identify the individual who can answer questions about the application and include his or her telephone number. This is typically the proposed Radiation Safety Officer (RSO), unless the applicant has named a different person as the contact. DHFS will contact this individual if there are questions about the application.

Notify DHFS if the contact person or his or her telephone number changes so that DHFS can contact the applicant or licensee in the future with questions, concerns, or information. This notice is for "information only" and does not require a license amendment or a fee.

Response from Applicant:

Item 3 Contact Person – Name
Contact Person - Telephone Number (Include area code)

Item 4: Address(es) Where Licensed Material Will Be Used or Possessed

Most applicants need to provide two types of information in response to **Item 4**:

- Description of storage, use, and dispatch locations; and
- Specification of whether they intend to use the portable gauge or XRF at temporary job sites.

Specify the street address, city, and state or other descriptive address (such as on Highway 10, 5 miles east of the intersection of Highway 10 and State Route 234, Anytown) for each permanent facility used as a location of storage or use, and each facility from which the applicant will dispatch gauge and XRF users to job sites. The descriptive address should be sufficient to allow a DHFS inspector to find the storage location. A Post Office Box address is not acceptable.

DHFS does not consider long-term storage in vehicles or personal residences not listed on the license an acceptable practice. As discussed in the above paragraph, in responding to **Item 4**, license applicants should also include a description of those locations, such as personal residences where portable gauges or XRFs may be stored by licensee staff for dispatch to customer job sites.

A DHFS-approved license amendment is required before receiving, using and storing licensed material at an address or location not included with the application or already listed on the license.

Being granted a DHFS license does not relieve a licensee from complying with other applicable federal, state, or local regulations (e.g.; local zoning requirements for storage locations)

If you will only use the portable gauge or XRF device at a specific location check the ‘used’ box. If you will only store the portable gauge or XRF device at a specific location check the ‘stored’ box. If you will use and store the portable gauge or XRF device at a specific location check the ‘Used/stored’ box. To conduct operations at temporary jobsites (i.e., locations where work is conducted for limited periods of time and from which gauge or XRF users are NOT dispatched to jobsites for other customers), check the ‘yes’ box.

Response from Applicant:

Item 4 List all address(es) where radioactive material(s) will be used or possessed. Attach additional pages if necessary.		
	Address (Do not use Post Office box)	Telephone Number (Include area code)
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used/Stored		
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used/Stored		
<input type="checkbox"/> Used <input type="checkbox"/> Stored <input type="checkbox"/> Used/Stored		

Are portable gauge devices and/or portable XRFs used at temporary jobsites?: ☐ Yes ☐ No

Note: As discussed later under ‘Financial Assurance and Record keeping for Decommissioning,’ licensees need to maintain permanent records on where licensed material was used or stored while the license was in force. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). For portable gauge licensees, acceptable records are sketches or written descriptions of storage or use locations specifically listed on the license. Licensees do not need to maintain this information for temporary job sites or temporary storage locations where sources have never leaked.

Item 5: Individual(s) Responsible for Radiation Safety Program and Their Training and Experience - Radiation Safety Officer (RSO)

Rule: *HFS 157.13(2); HFS 157.05(4)*

Criteria: RSOs must have adequate training and experience. DHFS will accept successful completion of one of the following as evidence of adequate training and experience:

- Portable gauge or XRFs manufacturer's course for users or for RSOs; and
- Equivalent course that meets **Appendix D** criteria.

Discussion: The person responsible for the radiation protection program is called the RSO. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner. Typical RSO duties are illustrated in **Figure 3** and described in **Appendix E**. DHFS requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO.

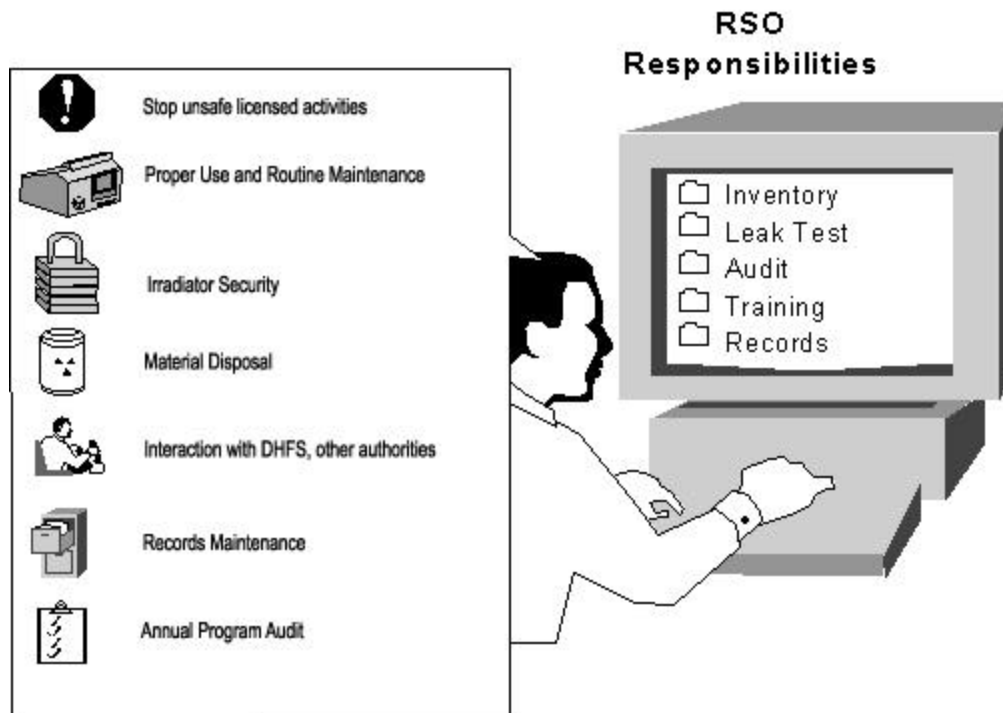


Figure 3. RSO Responsibilities: *Typical duties and responsibilities of RSOs.*

Response from Applicant:

Item 5 Radiation Safety Officer (RSO) (Attach evidence of training and experience and check one box)	
Name – Radiation Safety Officer	Telephone Number (Include area code)
<input type="checkbox"/> Before obtaining radioactive material, the proposed RSO will have successfully completed one of the training courses described in the Criteria section entitled “Individual(s) Responsible for Radiation Safety Program and Their Training and Experience- Radiation Safety Officer” in the WISREG “Guidance for Portable Gauge Devices or Portable XRFs.” Before being named as the RSO, future RSOs will have successfully completed one of the training courses described in the Criteria section entitled “ Individual(s) Responsible for Radiation Safety Program and Their Training and Experience- Radiation Safety Officer”, WISREG “Guidance for Portable Gauge Devices or Portable XRFs.”	
Or	
<input type="checkbox"/> Alternative information demonstrating that the proposed RSO is qualified by training and experience is attached. Before being named as the RSO, future RSOs will have successfully completed one of the training courses described in the Criteria section entitled “ Individual(s) Responsible for Radiation Safety Program and Their Training and Experience- Radiation Safety Officer”, WISREG “Guidance for Portable Gauge Devices or Portable XRFs.”	

Note:

- It is important to notify DHFS, as soon as possible, of changes in the designation of the RSO.
- Alternative responses will be reviewed against the criteria listed above.

Item 6: Training for Individuals Working in or Frequenting Restricted Areas

Rule: *HFS 157.88(1-2); HFS 157.89(4)(c); HFS 157.05(4); HFS 157.03(87); HFS 157.13(2).*

Criteria: Authorized users must have adequate training and experience. DHFS will accept successful completion of one of the following as evidence of adequate training and experience:

- Portable gauge or XRFs manufacturer's course for users
- Equivalent course that meets **Appendix D** criteria

Discussion: The individuals using the gauges or XRFs are usually referred to as authorized users. Authorized users have the responsibility to ensure the surveillance, proper use, security, and routine maintenance of portable gauges or XRFs containing licensed material.

Annual radiation safety training must be provided to individuals working in or frequenting restricted areas who receive or are likely to receive 100 mrem per year (*HFS 157.88(2)*).

Response from Applicant:

Item 6 Training for individuals working in or frequenting restricted areas (check one)

- ☐ Before using radioactive material, authorized users will have successfully completed one of the training courses described in the Criteria section entitled "Training for Individuals Working In or Frequenting Restricted Areas" in WISREG "Guidance for Portable Gauge Devices or Portable XRFs."

NOTE: If using an in-house training program, submit copy of course content, sample course examination and course instructor qualifications.

Or

- ☐ Documentation of the training and experience for the proposed gauge user(s) is attached.

Note:

- Records of training should be maintained.
- Alternative responses will be evaluated against the criteria listed above.

Item 7: Radioactive Material

Item 7.1: Radioactive Material - Sealed Sources and Devices and Purpose(s) for Which License Material will be Used

Rule: *HFS 157.13(1-2)*

Criteria: Licensees will only be authorized for sealed sources and devices registered by DHFS, the NRC or an Agreement State. Proposed activity is authorized by **Chapter HFS 157 ‘Radiation Protection’** and devices will be used only for the purposes for which they re designed and according to the manufacturer's recommendations for use as specified in an approved SSD Registration Sheet.

Discussion: NRC or an Agreement State performs a safety evaluation of gauges or XRFs before authorizing a manufacturer to distribute the gauges or XRFs to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) Registration Certificate, also called an SSD Registration Sheet. When issuing a portable gauge or XRF license, DHFS usually provides a generic authorization to allow the licensee to possess and use any sealed source/device combination that has been registered by NRC or an Agreement State. This method of authorization allows licensees flexibility in obtaining new source/device combinations without having to amend their licenses.

Consult with the proposed manufacturer or distributor to ensure that sources and devices conform to the sealed source and device designations registered with NRC or an Agreement State. Licensees may not make any changes to the sealed source, device, or source/device combination that would alter the description or specifications from those indicated in the respective registration certificates, without obtaining DHFS’s prior permission in a license amendment. Such changes may necessitate a custom review, increasing the time needed to process a licensing action.

SSD Registration Certificates contain sections on “Conditions of Normal Use” and “Limitation and Other Considerations of Use.” These sections may include limitations derived from conditions imposed by the manufacturer or distributor, by particular conditions of use that would reduce radiation safety of the device, or by circumstances unique to the sealed source or device. For example, working life of the device or appropriate temperature and other environmental conditions may be specified. Except as specifically approved by NRC, licensees are required to

use gauges according to their respective SSD Registration Certificates. Accordingly, applicants may want to obtain a copy of the certificate and review it with the manufacturer or distributor or with NRC or the issuing Agreement State to ensure that it correctly reflects the radiation safety properties of the source or device.

- Identify each radionuclide that will be used in each source in the gauging device(s);
- Identify the manufacturer or distributor and model number of each type of sealed source and device requested;
- Confirm that each sealed source, device, and source/device combination is registered as an approved sealed source or device by NRC or an Agreement State;
- Confirm that the activity per source will not exceed the maximum activity listed on the approved certificate of registration issued by NRC or by an Agreement State.
- The typical portable gauge license authorizes use "to measure physical properties of materials"; and
- Unusual uses will be evaluated on a case-by-case basis and the authorized use condition will reflect approved uses.

Response from Applicant:

Item 7 Radioactive Material (Attach additional pages if necessary)	
Element and mass number	Chemical and physical form SEALED SOURCE
Source manufacturer and model number	Maximum activity per source
Sealed source and device registration sheet number	Device manufacturer and model number
Intended use	

Note: Information on SSD registration certificates is also available electronically on NRC's Sealed Source and Devices Bulletin Board System (SS&D BBS) which can be accessed, free of charge, on the internet at: <http://www.hsrdo.ornl.gov/nrc/ssdrform.htm>. For information about the SS&D BBS or the new electronic location, contact the NRC's Registration Assistant at (301) 415-7231 or alternatively contact DHFS.

Item 7.2: Radioactive Material - Financial Assurance and Record Keeping for Decommissioning

Rule: *HFS 157.13(10) and (15); HFS 157.15*

Criteria: Portable gauge or XRF licensees possessing sealed sources containing radioactive material in excess of the limits specified in *HFS 157.15* must provide evidence of financial assurance for decommissioning.

Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where gauges or XRFs are used or stored and to leaking sources. Licensees must transfer records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with *HFS 157.13(10) & (15)* or to DHFS before the license is terminated.

Discussion: The requirements for financial assurance are specific to the types and quantities of radioactive material authorized on a license. Most portable gauge applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources are 3.7×10^6 gigabecquerels (100,000 curies) of cesium-137 or 3.7×10^3 gigabecquerels (100 curies) of americium-241 or californium-252. Thus, a licensee would need to possess hundreds of gauges (typically containing about 0.30 gigabecquerels (8 millicuries) of cesium-137 and 1.5 gigabecquerels (40 millicuries) of americium-241) before the financial assurance requirements would apply. Since the standard portable gauge license does not specify the maximum number of gauges that the licensee may possess (allowing the licensee flexibility in obtaining gauges as needed without amending its license), it contains a condition requiring the licensee to limit its possession of gauges to quantities not requiring financial assurance for decommissioning. Applicants and licensees desiring to possess gauges exceeding the threshold amounts must submit evidence of financial assurance.

The same rule also requires that licensees maintain records important to decommissioning in an identified location. All portable gauge licensees need to maintain records of structures and equipment where gauges are used or stored at locations specifically listed on the license. As-built drawings with modifications of structures and equipment shown as appropriate fulfill this requirement. If drawings are not available, licensees may substitute appropriate records concerning the areas and locations. In addition, if portable gauge licensees have experienced unusual occurrences (e.g., leaking sources, other

incidents that involve spread of contamination), they also need to maintain records about contamination that remains after cleanup or that may have spread to inaccessible areas.

For portable gauge licensees whose sources have never leaked, acceptable records important to decommissioning are sketches or written descriptions of portable gauge storage or use locations specifically listed on the license. Similar information need not be maintained for temporary job sites.

Licensees must transfer records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with *HFS 157.13(10) & (15)* or to DHFS before the license is terminated.

Reference: NRC *Regulatory Guide 3.66* “Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70 and 72,” is available from the NRC upon request.

Item 8: Facilities and Equipment

Rule: *HFS 157.22; HFS 157.23; HFS 157.28; HFS 157.21*

Discussion: The key elements for portable gauge or XRF applicants are ensuring compliance with public dose limits and maintaining adequate security and control over the gauges or XRFs. These issues are covered under ‘Public Dose’ and ‘Operating and Emergency Procedures.’

Response from Applicant:

Item 8 Facilities And Equipment (Check box and attach diagram.)

☐ Diagrams of radioactive material storage area(s) are attached.

ITEM 9: Radiation Safety Program

Item 9.1: Audit Program

Rule: *HFS 157.21; HFS 157.31(2)*

Criteria: Licensees must review the content and implementation of their radiation protection programs annually to ensure the following:

- Compliance with DHFS and DOT regulations, and the terms and conditions of the license;
- Occupational doses and doses to members of the public are as low as reasonably achievable (*ALARA*) (*HFS 157.21*); and
- Records of audits and other reviews of program content are maintained for 3 years.

Discussion: **Appendix F** contains a suggested audit program that is specific to the use of portable gauges or XRFs and is acceptable to DHFS. All areas indicated in **Appendix F** may not be applicable to every licensee and may not need to be addressed during each audit.

Currently DHFS's emphasis in inspections is to perform actual observations of work in progress. As a part of their audit programs, applicants should consider performing unannounced audits of gauge users in the field to determine if, for example, Operating and Emergency Procedures are available, are being followed, etc.

It is essential that once identified, problems be corrected comprehensively and in a timely manner; NRC *Information Notice (IN) 96-28*, "Suggested Guidance Relating to Development and Implementation of Corrective Action," provides guidance on this subject. DHFS will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If violations are identified by the licensee and these steps are taken, DHFS can exercise discretion and may elect not to cite a violation. DHFS's goal is to encourage prompt identification and prompt, comprehensive correction of violations and deficiencies.

With regard to audit records, *HFS 157.31 (2)* requires licensees to maintain records of "... audits and other reviews of program content and implementation." DHFS has found audit records that contain the following information to be acceptable: date of audit, name of person(s) who conducted audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions, and follow-up.

Response From Applicant:

Item 9.1 Audit Program

The applicant is not required to submit its audit program to the department for review during the licensing phase. This matter will be examined during an inspection.

Item 9.2: Termination of Activities

Rule: *HFS 157.13(10),(11) and (15); HFS 157.15; HFS 157.31*

Criteria: The licensee must do the following:

- Notify DHFS in writing, within 30 days of the decision to permanently discontinue all activities involving materials authorized under the license.
- Notify DHFS in writing, within 60 days, when principal activities have not been conducted for a period of 24 months.
- Certify the disposition of licensed materials by submission of *DPH 45007 "Certificate of Disposition of Materials."* (See **Appendix L**).
- Before a license is terminated, send the records important to decommissioning (as required by *HFS 157.15*) to DHFS. If licensed activities are transferred or assigned in accordance with *HFS 157.13(15)*, transfer records important to decommissioning to the new licensee.

Discussion: For guidance on the disposition of licensed material, see the **Item 9.11 Waste Management - Gauge Disposal or Transfer**. For guidance on decommissioning records, see the section on 'Financial Assurance and Record keeping for Decommissioning.'

Response from Applicant:**Item 9.2 Termination Of Activities** (Check box)

- ☐ We will notify DHFS, in writing, within 30 days of the decision to permanently cease radioactive material use. s. HFS 157.13 (10)(d)

Item 9.3: Instruments

Rule: *HFS 157.13(2); HFS 157.05(3); HFS 157.52(4)*

Criteria: A radiation survey meter should:

- Be capable of detecting gamma radiation;
- Be calibrated on an interval not to exceed 12 months and after each instrument servicing; and
- Be checked for functionality before use (e.g., with the gauge or a check source).

Discussion: Each year there are a number of incidents involving gauges at construction sites (e.g., construction equipment running over the gauge). It is important to determine as soon as possible after an incident, by the use of a radiation survey meter, whether the shielding and source are intact.

Portable gauge licensees are required by *HFS 157.05(3)* to have a calibrated and operable radiation survey instrument available at each site where the portable gauge is used. XRF licensees are not required to have a radiation survey instrument.

Response from Applicant:

<p>Item 9.3 Survey Equipment (Check one box)</p> <p><input type="checkbox"/> We will possess and use a radiation survey meter that meets the Criteria in the section entitled "Radiation Safety Program-Instruments" in WISREG "Guidance for Portable Gauges or XRF Devices."</p> <p style="text-align: center;">Or</p> <p><input type="checkbox"/> We will submit an alternative procedure for determining source integrity after an incident involving the portable gauge(s). (Procedures are attached)</p> <p style="text-align: center;">Or</p> <p><input type="checkbox"/> Not Applicable [XRF Device(s)]</p>

Note:

- XRF licensees are not required to have a radiation survey instrument.
- Prior to non-routine maintenance that requires removing the source or source rod from the gauge a calibrated and operable radiation survey instrument will be required.

Item 9.4: Material Receipt and Accountability

Rule: *HFS 157.06, HFS 157.13(9)(b), (10),(15) and (18); HFS 157.31*

Criteria: Licensees must do the following:

- Maintain records of receipt, transfer, and disposal of gauges or XRFs; and
- Conduct physical inventories at intervals not to exceed 6 months (or some other interval justified by the applicant) to account for all sealed sources.

Discussion: As illustrated in **Figure 4**, licensed materials must be tracked from "cradle to grave" in order to ensure gauge accountability, identify when gauges or XRFs could be lost, stolen, or misplaced, and ensure that, if the licensee possesses gauges exceeding threshold amounts, the licensee complies with financial assurance requirements in *HFS 157.15*. Many licensees record daily use of gauges or XRFs in a logbook as part of their accountability program; see the suggested Operating Procedures in **Appendix H**.

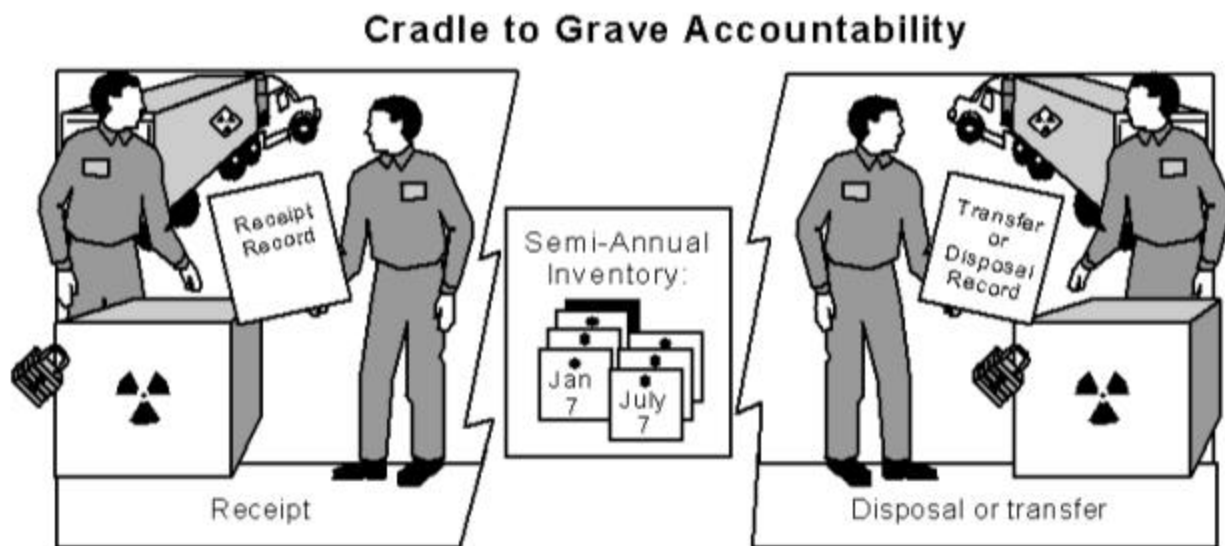


Figure 4. Material Receipt and Accountability. Licensees must maintain records of receipt and disposal and conduct semiannual inventories.

Response from Applicant:

Item 9.4 Material Receipt And Accountability (Check one box)

- ☐ We will conduct physical inventories at intervals not to exceed 6 months, to account for all sealed sources and devices received and possessed under the license.
- Or
- ☐ We will submit a description of the frequency and procedures for ensuring that no gauge has been lost, stolen, or misplaced. (Procedures are attached)

Note:

- Alternative responses will be evaluated against the criteria listed above.
- Inventory records should be maintained and contain the following types of information:
 - Radionuclide and amount (in units of becquerels or curies) of radioactive material in each sealed source;
 - Manufacturer's name, model number, and serial number (if appropriate) of each device containing radioactive material;
 - Location of each sealed source and device; and
 - Date of the inventory.

Item 9.5: Occupational Dosimetry

Rule: *HFS 157.25(2); HFS 157.22(1)(7-8); HFS 157.25(2)(a)(6)*

Criteria: Applicants must do either of the following:

- Provide dosimetry processed and evaluated by a National Voluntary Laboratory Accreditation Program (NVLAP) approved processor that is exchanged at a frequency recommended by the processor. *Portable gauge licensees must provide dosimetry processed and evaluated by NVLAP.*
- OR**
- Maintain, for inspection by DHFS, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits as shown in **Figure 5**.

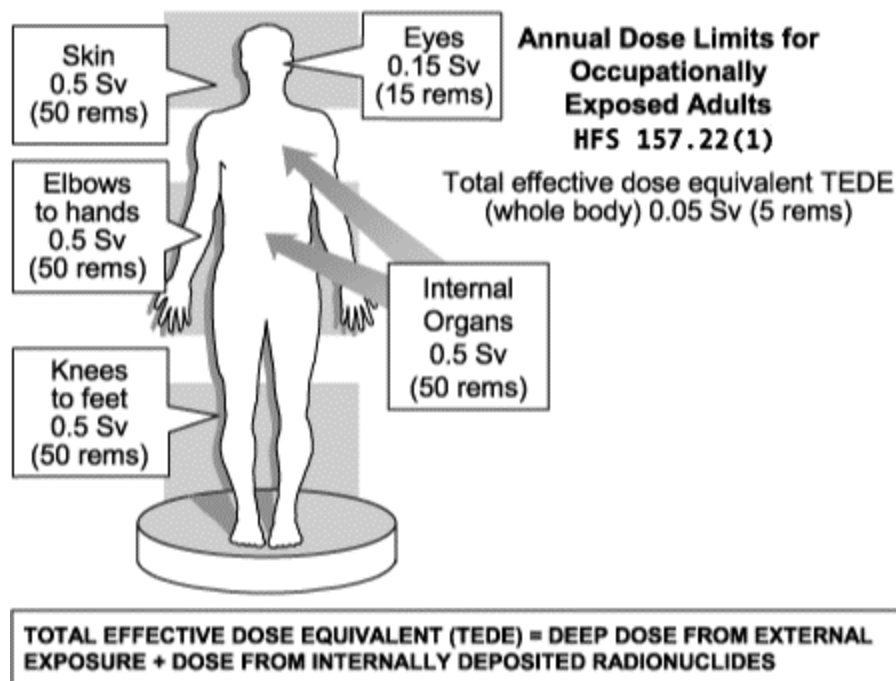


Figure 5. Annual Dose Limits for Radiation Workers.

Discussion: Under conditions of routine use, the typical XRF user does not require a personnel monitoring device (dosimetry). However a written evaluation demonstrating that XRF users are not likely to exceed 10 percent of the applicable limits and thus, are not required to have personnel dosimetry is required. **Appendix I Part 1** provides guidance on preparing this written evaluation.

Most licensees use either film badges, optically stimulated luminescent (OSLs) or thermoluminescent dosimeters (TLDs) that are supplied by an NVLAP-approved processor. The exchange frequency for film badges is usually monthly due to technical concerns about film fading. The exchange frequency for TLDs is usually quarterly. Applicants should verify that the processor is NVLAP-approved. Consult the NVLAP-approved processor for its recommendations for exchange frequency and proper use.

Response from Applicant:

Item 9.5 Occupational Dosimetry (Check one)

- ☐ We will maintain, for inspection by DHFS, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits in s. HFS 157.22.
- Or
- ☐ We will provide dosimetry processed and evaluated by a NVLAP-approved processor that is exchanged at a frequency recommended by the processor. (Note: Individuals operating portable moisture or density measuring devices must be monitored for occupational exposure to radiation, s. HFS 157.25(2)(a)6.)

Reference: *National Institute of Standards and Technology (NIST) Publication 810, "National Voluntary Laboratory Accreditation Program Directory,"* is published annually and is available for

purchase from **United States Government Printing Office** and on the Internet at the following address: <http://nvl.nist.gov/>

Item 9.6: Public Dose

Rule: *HFS 157.23 (1-2); HFS 157.03; HFS 157.28 (1) (a) and (b); HFS 157.31 (8)*

Criteria: Licensees must do the following:

- Ensure that licensed gauges will be used, transported, and stored in such a way that members of the public will not receive more than 1 millisievert (100 millirem) in one year, and the dose in any unrestricted area will not exceed 0.02 millisievert (2 millirem) in any one hour, from licensed operations.
- Control and maintain constant surveillance over gauges that are not in storage and secure stored gauges from unauthorized removal or use.

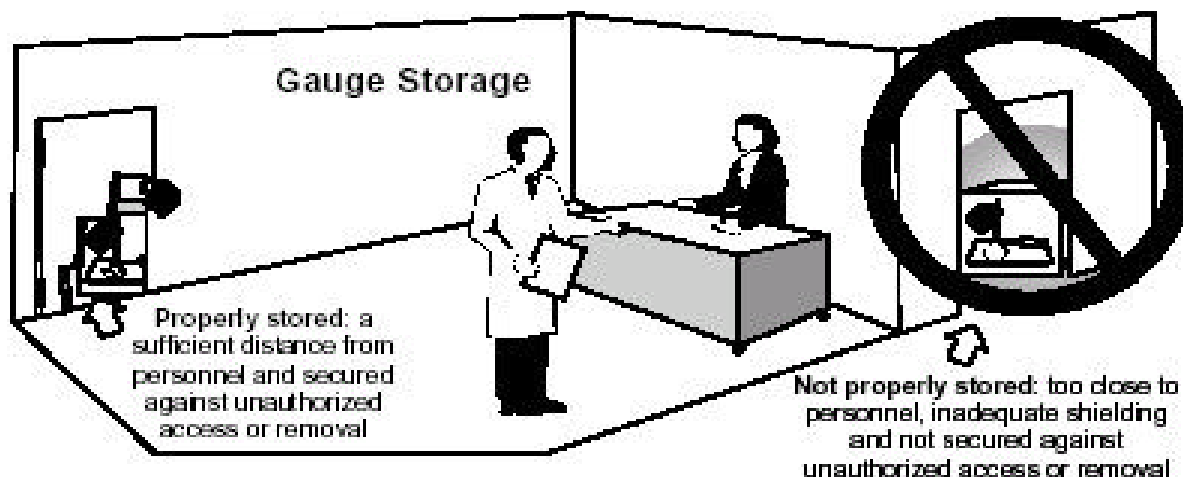


Figure 6. Storing Gauges. *Gauges should be stored away from occupied areas and secured against unauthorized removal.*

Discussion: Members of the public include persons who live, work, or may be near locations where portable gauges or XRFs are used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where gauges or XRFs are used or stored.

Operating and emergency procedures regarding security and surveillance specified under that section of this document should be sufficient to limit the exposure to the public during use or storage and after accidents. Public dose is controlled, in part, by ensuring that gauges and XRFs not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. See **Figure 6**. If gauges and XRFs are not in storage, then authorized users must maintain constant surveillance to ensure that members of the public, who could be co-workers, cannot get near the gauges or XRFs nor use them, and thus receive unneeded radiation exposure.

Public dose is also affected by the choice of storage location and conditions. Since a gauge or XRF presents a radiation field during storage, it must be stored so that the radiation level in an unrestricted area (e.g., an office or the exterior surface of an outside wall) does not exceed 1 mSv (100 mrem) in a year or 0.02 mSv (2 mrem) in any one hour. Use the concepts of time, distance, and shielding when choosing a permanent or temporary storage location. Decreasing the time spent near a gauge or XRF, increasing the distance from the gauge or XRF, and using shielding (i.e., brick, concrete, lead, or other solid walls) will reduce the radiation exposure. As a rule of thumb, gauges and XRFs should be stored as far away as possible from areas that are occupied by members of the public.

Licensees can determine the radiation levels adjacent to the storage location either by calculations or a combination of direct measurements and calculations using any or all of the following: typical known radiation levels provided by the manufacturer, the "inverse square" law to evaluate the effect of distance on radiation levels, and occupancy factors to account for the actual presence of the member of the public and of the gauge(s) or XRF(s). See **Part 2 of Appendix I** for examples.

If, after making an initial evaluation, a licensee makes changes affecting the storage area (e.g., changing the location of gauges or XRFs within the storage area, removing shielding, adding gauges or XRFs, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must ensure that gauges and XRFs are properly secured, perform a new evaluation to ensure that the public dose limits are not exceeded, and take corrective action, as needed.

Response from Applicant:

Item 9.6 Public Dose

No response is required, in this license application, however the licensee's evaluation of public dose will be examined during an inspection.

Item 9.7: Operating and Emergency Procedures

Rule: *HFS 157.13 (9) (a) and (b); HFS 157.21; HFS 157.32 (1-3); HFS 157.13(17); HFS 157.28 (1) (a) and (b);*

Criteria: Each applicant must do the following:

- Develop, implement, and maintain operating and emergency procedures containing the following elements:
 - Instructions for using the portable gauge or XRF and performing routine maintenance, according to the manufacturer's recommendations and instructions;
 - Instructions for maintaining security during storage and transportation;
 - Instructions to keep the gauge or XRF under control and immediate surveillance during use;
 - Steps to take to keep radiation exposures ALARA;
 - Steps to maintain accountability during use;
 - Steps to control access to a damaged gauge or XRF; and
 - Steps to take, and whom to contact, when a gauge or XRF has been damaged.
- If gauges are used for measurements with the unshielded source extended more than 3 feet beneath the surface, licensees must do the following:
 - require use of surface casing or alternative procedures to ensure the source can move freely in the hole;
 - provide instructions for procedures to follow to retrieve a stuck source; and
 - require reporting to DHFS, pursuant to *HFS 157.13 (17)*, when a stuck source cannot be retrieved.
- Provide copies of operating and emergency procedures to all gauge or XRF users and at each job site.

Proper Handling of Incidents

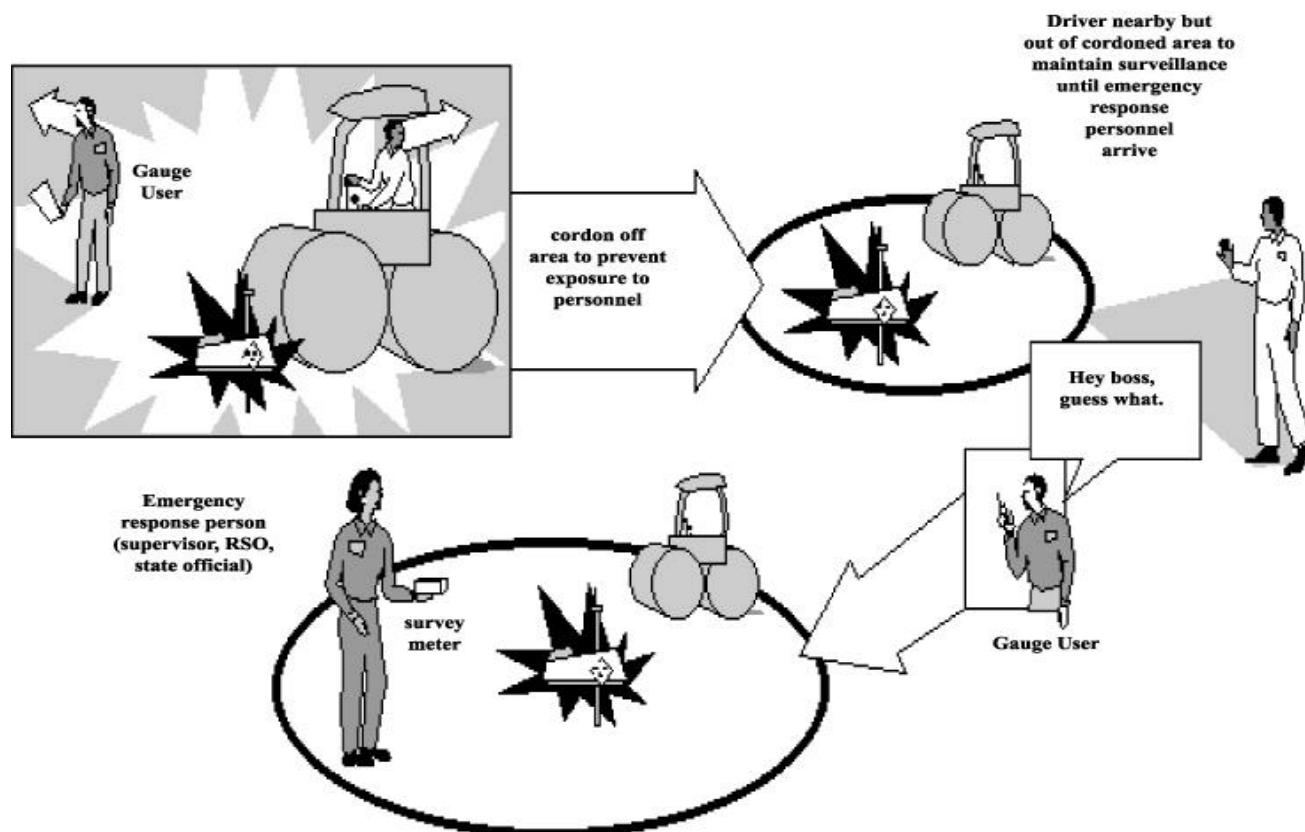


Figure 7. Proper Handling. Gauges are often damaged by heavy equipment at job sites and emergency procedures need to minimize radiation safety risk.

Discussion: Lost or stolen gauges or XRFs and, as illustrated in **Figure 7**, gauges damaged by heavy equipment during use at job sites are the most common occurrences that present a potentially significant radiation safety risk. **Figure 8** illustrates steps that should be taken to prevent loss, theft, or unauthorized use. Additional discussion on the prevention of thefts can be found in NRC IN 2001-11. In particular, when gauges are not in use, licensees are encouraged to:

- Keep gauges locked in covered vehicle compartments; and
- Avoid parking vehicles in areas vulnerable to theft.

Operating and emergency procedures should be developed to minimize these risks. DHFS considers security of gauges and XRFs extremely important and lack of security is a significant violation for which gauge or XRF licensees are fined. See **Appendix H** for sample procedures.

Certain portable gauges are used to make measurements with the unshielded source extended more than 3 feet beneath the surface. Unless precautionary measures are taken, it is possible for the source to be

buried under dirt or concrete that collapses around the source during the measurements. Precautionary measures need to be planned in advance to prevent these sources from being buried and to recover sources should they become stuck. To ensure that the hole is free of debris, it is not likely that debris will re-enter the cased hole, and the source will be able to move freely, it is acceptable for licensees to use surface casing from the lost depth to 12 inches above the surface. If it is not feasible to extend the casing 12 inches above the surface, licensees may cap the hole and use dummy probes before making measurements with an unshielded source to ensure that the hole is free of obstructions.

Notify DHFS when gauges or XRFs are lost, stolen, or certain other conditions are met. Refer to the rule for a description of when and where notifications are required.

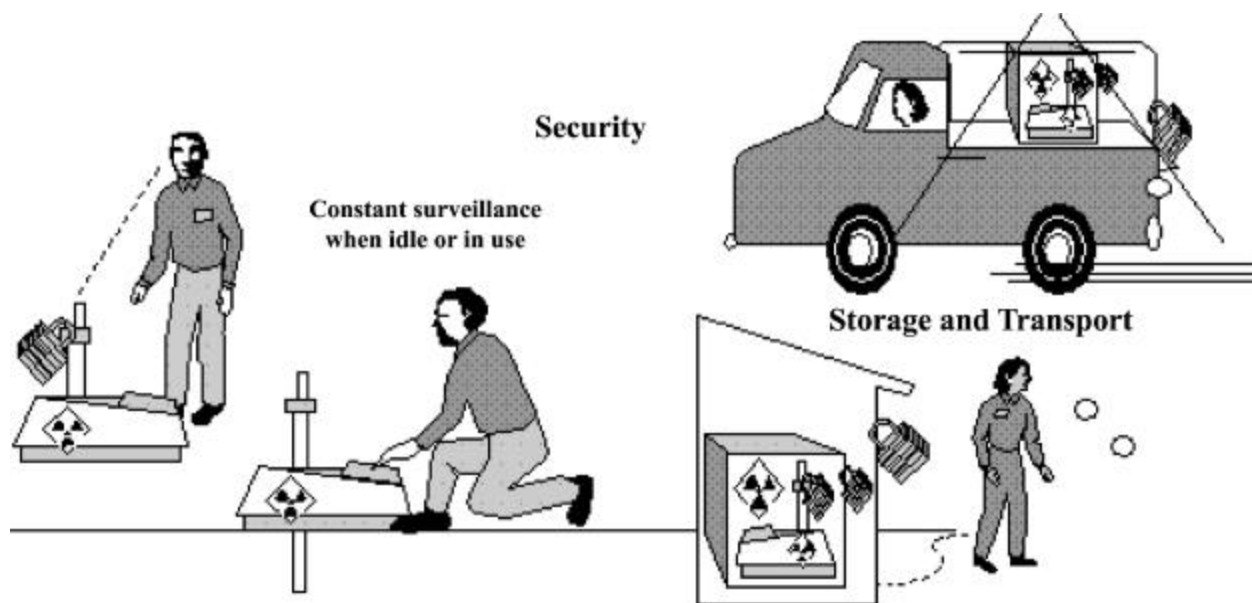


Figure 8. Security. To avoid lost or stolen gauges, licensees must keep the gauges under constant surveillance, or secured against unauthorized use or removal.

Response from Applicant:

Item 9.7 Operating And Emergency Procedures (Check one box)

- ☐ We will implement and maintain the operating and emergency procedures in Appendix H of WISREG "Guidance for Portable Gauges or XRF Devices" and provide copies of these procedures to all gauge or XRF users and at each job site.
- Or
- ☐ Operating and emergency procedures will be developed, implemented, and maintained, and will meet criteria in the section entitled 'Radiation Safety Program – Operating and Emergency Procedures' in WISREG "Guidance for Portable Gauges or XRF Devices." (Procedures are attached)

Note: Alternative procedures will be reviewed against the criteria listed above.

Item 9.8: Leak Tests

Rule: *HFS 157.24*

Criteria: DHFS requires testing to determine whether there is any radioactive leakage from the source in the device. DHFS finds testing to be acceptable if it is conducted by an organization approved by DHFS, the NRC or an Agreement State or according to procedures approved by DHFS, the NRC or an Agreement State.

Discussion: A licensee will be required to perform leak tests at intervals not to exceed six months unless otherwise approved by DHFS, the NRC or an Agreement State and it is documented in the SSD Registration Sheet. The measurement of the leak-test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 becquerels (0.005 microcurie) of radioactivity.

Manufacturers, consultants, and other organizations may be authorized by DHFS, the NRC or an Agreement State to either perform the entire leak test sequence for other licensees or provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the gauge or XRF manufacturer's and the kit supplier's instructions and return it to the kit supplier for evaluation and reporting results. Licensees may also be authorized to conduct the entire leak test sequence themselves. Leak test samples should be collected at the most accessible area where contamination would accumulate if the sealed source re leaking.

Response from Applicant:

Item 9.8 Leak Tests (Check one)

- ☐ Leak tests will be performed by an organization authorized by DHFS, the NRC or an Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by DHFS, the NRC or an Agreement State to provide leak test kits to other licensees according to kit supplier's instructions.

List Name and License number of organization authorized to perform or analyze leak test (Specify whether DHFS, NRC, or other Agreement State)

Organization Name _____ License Number _____

Note: An alternate organization may be used to perform or analyze leak test, without amending the license, provided the organization is specifically authorized by DHFS, NRC, or an Agreement State.

Or

- ☐ We will perform leak testing and sample analysis and will follow the model procedures in Appendix K of WISREG "Guidance for Portable Gauges or XRF Devices." (Procedures are attached)

Or

- ☐ We will submit alternative procedures. (Procedures are attached)

Note: Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, DHFS staff will authorize via a license condition.

Item 9.9: Maintenance

Rule: *HFS 157.21; HFS 157.13(9)(b) and (10);*

Criteria: Licensees must routinely clean and maintain gauges and XRFs according to the manufacturer's recommendations and instructions. For gauges with a source rod, radiation safety procedures for routine cleaning and lubrication of the source rod and shutter mechanism (e.g., to remove caked dirt, mud, asphalt, or residues from the source rod; lubricate the shutter mechanism) must consider the possibility of receiving exposures to the whole body, as well as to the hands, from handling the source rod. Licensees should keep such exposures ALARA and ensure that the gauge functions as designed and source integrity is not compromised.

Non-routine maintenance or repair (beyond routine cleaning and lubrication) that involves detaching the source or source rod from the device and any other activities during which personnel could receive radiation doses exceeding DHFS limits must be performed by the gauge manufacturer or a person specifically authorized by DHFS, the NRC or an Agreement State. ***XRF users are not allowed to perform non-routine maintenance, the XRF manufacturer must perform all non-routine***

maintenance. Requests for specific authorization to perform non-routine maintenance or repair (see **Appendix G**) must demonstrate that personnel performing the work do the following:

- Have adequate training and experience;
- Use equipment and procedures that ensure compliance with regulatory requirements, and consider ALARA; and
- Ensure that the gauge functions as designed and that source integrity is not compromised.

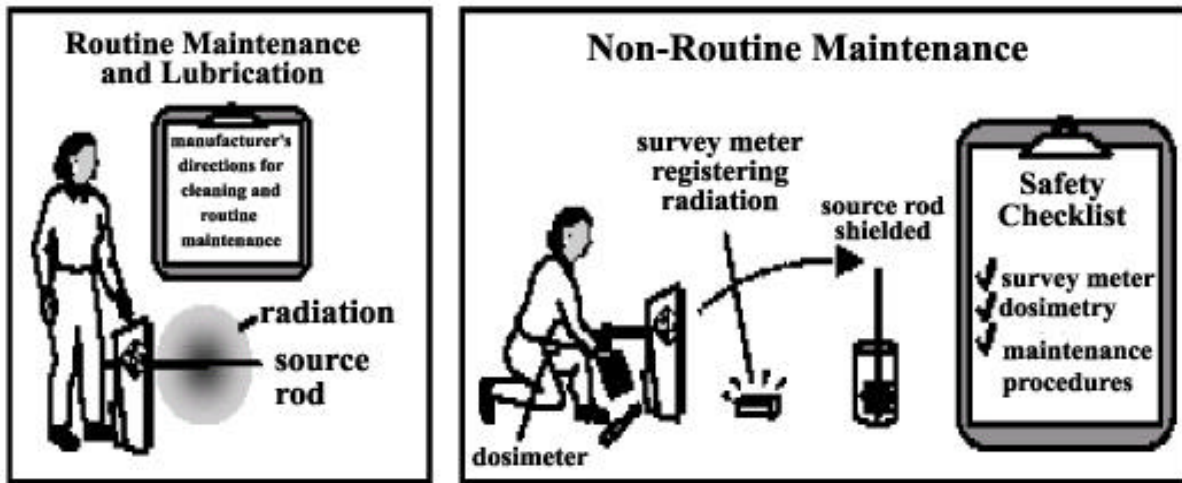


Figure 9. Maintenance. All licensees need to perform routine cleaning and lubrication to ensure proper operation of gauges and XRFs.

Discussion: Figure 9 illustrates routine cleaning and lubrication and non-routine maintenance. DHFS permits portable gauge licensees to perform routine maintenance of the gauges provided that they follow the gauge manufacturer's recommendations and instructions. Although manufacturers may use different terms, "routine maintenance" includes, but is not limited to, cleaning, lubrication, changing batteries or fuses, repairing or replacing a handle. Routine maintenance does NOT include any activities that require removing the sealed source or source rod from the gauge.

DHFS license will state that any cleaning, maintenance, or repair of gauges that requires detaching the source or source rod from the gauge shall be performed only by the manufacturer or other persons specifically licensed by DHFS, the NRC or an Agreement State to perform such services. Most licensees do not perform non-routine maintenance or repair operations that require detaching the source or source rod from the gauge; they usually return the gauge to the manufacturer. Applicants seeking authorization to detach the source or source rod from the device must submit specific procedures for review. See **Appendix G** for more information.

Response from Applicant:

Item 9.9 Maintenance (Check one)

Routine cleaning and lubrication:

- ☐ We will implement and maintain procedures for routine maintenance of our gauge(s) or XRF(s) according to each manufacturer's recommendations and instructions.
- ☐ Alternative procedures are attached.

Or

Non-routine maintenance:

- ☐ We will send the gauge(s) or XRF(s) to the manufacturer or other person authorized by DHFS, the NRC or an Agreement State to perform non-routine maintenance or repair operations that require the removal of the source or source rod from the gauge(s) or XRF(s).

Or

- ☐ We will provide the information listed in Appendix G of WISREG "Guidance for Portable Gauges or XRF Devices " to support a request to perform this work "in house."

Note:

- Alternative procedures for performing routine cleaning and lubrication will be reviewed according to the criteria listed above.
- Information requested in **Appendix G** will be reviewed on a case-by-case basis; if approved, the portable gauge license will contain a condition authorizing the licensee to perform non-routine maintenance.

Item 9.10: Transportation

Rule: *HFS 157.92(3); HFS 157.21; 49 CFR Parts 171-178*

Criteria: Applicants must develop, implement, and maintain safety programs for public transport of radioactive material to ensure compliance with DOT regulations.

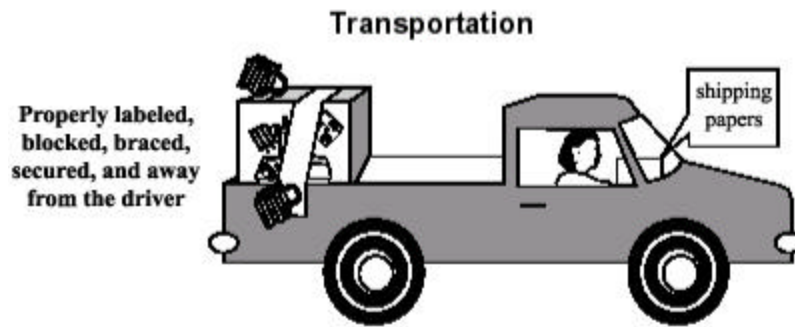


Figure 10. Transportation. Licensees often transport their gauges and XRFs to and from job sites and must ensure compliance with Department of Transportation regulations.

Discussion: Figure 10 illustrates some DOT requirements often overlooked by portable gauge licensees. For example, the labeling of the transport container must be maintained in a legible condition. With regard to blocking and bracing, the licensee must assure that the transport container does not shift during transport. During an inspection DHFS inspects and enforces DOT's regulations governing the transport of radioactive materials by DHFS's licensees. **Appendix K** lists major DOT regulations and provides a sample shipping paper for portable gauges.

XRF users typically are not required to have shipping papers however, a certification statement (**49 CFR 173.422 (a)(2)**), and the name of the consignor or consignee, must be included with the XRF device whenever it is transported or shipped. See **49 CFR 173.424** for DOT requirements concerning Excepted packages for radioactive instruments and articles. See **Appendix B** for Sample XRF Certification Statement.

Response from Applicant:

Item 9.10 Transportation

No response is needed during the license process; this issue will be reviewed during inspection.

Item 9.11: Waste Management - Gauge Disposal and Transfer

Rule: *HFS 157.30(1); HFS 157.13(15); HFS 157.13(18)*

Criteria: Licensed materials must be disposed of in accordance with DHFS requirements by transfer to an authorized recipient. Appropriate records must be maintained.

Discussion: Significant problems can arise from improper gauge or XRF transfer or failure to dispose of gauges or XRFs in a proper and timely manner. Such problems include the possession of radioactive materials by unauthorized individuals which could result in exposures to members of the general public. When disposing of portable gauges or XRFs, licensees must transfer them to an authorized recipient. Authorized recipients are the original manufacturer of the device, a commercial firm licensed by DHFS, the NRC or an Agreement State to accept radioactive waste from other persons, or another specific licensee authorized to possess the licensed material (i.e., their license specifically authorizes the radionuclide and the use).

Before transferring radioactive material, a licensee must verify that the recipient is properly authorized to receive it using one of the methods described in *HFS 157.13 (15)*. In addition, all packages containing radioactive sources must be prepared and shipped in accordance with DHFS and DOT regulations. Records of the transfer must be maintained as required by *HFS 157.13(18)*.

Response from Applicant:

Item 9.11 Waste Management - Gauge or XRF Disposal And Transfer (Check box)

- ☐ We will transfer the gauge or XRF to the manufacturer for disposal or transfer the device to a specific licensee, authorized to receive radioactive material.

Note: Because of the difficulties and costs associated with disposal of Americium-241 sealed neutron sources, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the source supplier as part of a purchase agreement.

Item 10: Fees

On *DHFS Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges Or XRF Devices, DPH 45006* enter the fee category and the amount. Enclose fee with the application.

Response from Applicant:

Item 10 License Fees (Refer to Wisconsin Administrative Code HFS 157.10)	
Category:	License Fee Enclosed <input type="checkbox"/> Yes <input type="checkbox"/> No Amount Enclosed \$

Item 11: Certification

Individuals acting in a private capacity are required to sign and date *DPH 45006 ‘Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges or XRF Devices’*. Otherwise, senior representatives of the corporation or legal entity filing the application should sign and date *DPH 45006 ‘Application for Radioactive Material License Authorizing the Use of Sealed Sources in Portable Gauges or XRF Devices’*.

Representatives signing an application must be authorized to make binding commitments and sign official documents on behalf of the applicant. As discussed previously in ‘Management Responsibility,’ signing the application acknowledges management's commitment and responsibilities for the radiation protection program. **DHFS will return all unsigned applications for proper signature.**

Note:

- It is a violation of **Chapter HFS 157 ‘Radiation Protection’** to make a willful false statement or representation on applications or correspondence.
- When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

Response from Applicant:

Item 11

I hereby certify that this application was prepared in conformance with Wisconsin Administrative Code HFS 157 "Radiation Protection" and that all information contained herein, including any supplements attached hereto, is true and correct to the best of my knowledge and belief.

SIGNATURE - Applicant Or Authorized Individual

Date signed

Print Name and Title of above signatory

Appendix A:
Department of Health and Family Services
Radiation Protection Section

DPH 45006
Application For Radioactive Material License
Authorizing the Use of Sealed Sources in Portable
Gauges or XRF Devices

To access this form please go to
<http://dhfs.wisconsin.gov/forms/DPH/dph45006.pdf>

Appendix B:
SAMPLE XRF CERTICATION STATEMENT

**“THIS PACKAGE CONFORMS TO THE
CONDITIONS AND LIMITATIONS
SPECIFIED IN 49 CFR 173.424 FOR
RADIOACTIVE MATERIAL, EXCEPTED
PACKAGE-INSTRUMENTS OR
ARTICLES, UN2910”**

Appendix C:
Information Needed for Change of Ownership or Control
Application

Licensees must provide full information and obtain DHFS's **prior written consent** before transferring ownership or control of the license; some licensees refer to this as "transferring the license." Provide the following information concerning changes of ownership or control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state.

1. The new name of the licensed organization. If there is no change, the licensee should so state.
2. The new licensee contact and telephone number(s) to facilitate communications.
3. Any changes in personnel having control over licensed activities (e.g., officers of a corporation) and any changes in personnel named in the license such as radiation safety officer, authorized users, or any other persons identified in previous license applications as responsible for radiation safety or use of licensed material. The licensee should include information concerning the qualifications, training, and responsibilities of new individuals.
4. An indication of whether the transferor will remain in non-licensed business without the license.
5. A complete, clear description of the transaction, including any transfer of stocks or assets, mergers, etc., so that legal counsel is able, when necessary, to differentiate between name changes and changes of ownership.
6. A complete description of any planned changes in organization, location, facility, equipment, or procedures (i.e., changes in operating or emergency procedures).
7. A detailed description of any changes in the use, possession, location, or storage of the licensed materials.
8. Any changes in organization, location, facilities, equipment, procedures, or personnel that would require a license amendment even without the change of ownership.
9. An indication of whether all surveillance items and records (e.g., calibrations, leak tests, surveys, inventories, and accountability requirements) will be current at the time of transfer. Provide a description of the status of all surveillance requirements and records.

10. Confirmation that all records concerning the safe and effective decommissioning of the facility, pursuant to **HFS 157.15**; public dose; and waste disposal by release to sewers, incineration, radioactive material spills, and on-site burials, have been transferred to the new licensee, if licensed activities will continue at the same location, or to DHFS for license terminations.
11. A description of the status of the facility. Specifically, the presence or absence of contamination should be documented. If contamination is present, will decontamination occur before transfer? If not, does the successor company agree to assume full liability for the decontamination of the facility or site?
12. A description of any decontamination plans, including financial assurance arrangements of the transferee, as specified in **HFS 157.15**. Include information about how the transferee and transferor propose to divide the transferor's assets, and responsibility for any cleanup needed at the time of transfer.
13. Confirmation that the transferee agrees to abide by all commitments and representations previously made to DHFS by the transferor. These include, but are not limited to: maintaining decommissioning records required by **HFS 157.15**; implementing decontamination activities and decommissioning of the site; and completing corrective actions for open inspection items and enforcement actions.

With regard to contamination of facilities and equipment, the transferee should confirm, in writing, that it accepts full liability for the site, and should provide evidence of adequate resources to fund decommissioning; or the transferor should provide a commitment to decontaminate the facility before change of control or ownership.

With regard to open inspection items, etc., the transferee should confirm, in writing, that it accepts full responsibility for open inspection items and/or any resulting enforcement actions; or the transferee proposes alternative measures for meeting the requirements; or the transferor provides a commitment to close out all such actions with DHFS before license transfer.

14. Documentation that the transferor and transferee agree to the change in ownership or control of the licensed material and activity, and the conditions of transfer; and the transferee is made aware of all open inspection items and its responsibility for possible resulting enforcement actions.
15. A commitment by the transferee to abide by all constraints, conditions, requirements, representations, and commitments identified in the existing license. If not, the transferee must provide a description of its program, to ensure compliance with the license and DHFS Rule.

Appendix D:

**Criteria for Acceptable Training Courses for Portable
Gauge or XRF Users**

Criteria for Acceptable Training Courses for Portable Gauge Users

Course Content

The following are areas in which DHFS considers it important that an individual have expertise for the competent operation of portable gauges and XRF devices using sealed sources of radioactive material. The course shall be at least 8 hours in length.

I. PRINCIPLES AND FUNDAMENTALS OF RADIATION SAFETY

- A. Types and Characteristics of Radiation
 - 1. Alpha, Beta, Gamma, X-ray and Neutron Radiation
 - 2. Exposure: Natural versus Man-made Radiation
 - 3. Irradiation versus Contamination/Internal vs. External
 - 4. Radioactive Material Used in Portable Gauges and XRF Devices
- B. Units of Radiation Dose and Quantities of Radioactivity
 - 1. Curie, Rad, Rem and Roentgen
 - 2. Prefixes
 - 3. SI Units
- C. Basic Math and Calculations Related to Radioactivity
 - 1. Radioactive Decay
 - 2. Dose Rates from the sources commonly used
 - 3. Inverse Square Law
- D. Biological Effects of Radiation
 - 1. Acute, Chronic, and Genetic Effects of Exposure
 - 2. Radiation Protection Standards
 - 3. The ALARA Philosophy
- E. Radiation levels from Radioactive Sealed Sources
 - 1. Survey Meter Use for Portable Gauge Users, not including XRF devices
- F. Methods of Controlling Radiation Dose
 - 1. Time
 - 2. Distance
 - 3. Shielding

II. STATE AND FEDERAL REGULATIONS

- A. Chapter HFS 157, Wisconsin Administrative Code
- B. Title 10, Code of Federal Regulations, US Nuclear Regulatory Commission
- C. Title 49, Code of Federal Regulations, Transportation

III. LICENSING AND INSPECTION

- A. License Items and Conditions
- B. Notices, Instructions and Reports to Workers
- C. Inspection by DHFS

IV. OPERATING AND EMERGENCY PROCEDURES

- A. Operating Procedures
 - 1. Training and Supervision
 - 2. Personnel Monitoring
 - 3. Availability of Procedures
 - 4. Security of the Gauges or Devices When Stored and At The Work Location
 - 5. ALARA Philosophy
 - 6. Transportation of the Gauges or Devices and Security
 - 7. General Rules of Use
 - 8. Posting Requirements
 - 9. Routine Maintenance
 - 10. Radiation Surveys Using Survey Meters at the Work Site for Portable Gauges
- B. Emergency Procedures
 - 1. Preventive Measures
 - 2. Emergency Response
 - 3. Notification Requirements
 - 4. Case Histories

V. TRANSFER/ DISPOSAL REQUIREMENTS

- A. DHFS and NRC Regulations
- B. Transportation Requirements

VI. PRACTICAL TRAINING

- A. Transport/ Storage Containers
- B. Hands-on Training Specific to the Gauge or Device
 - 1. Proper Use
 - 2. Safe Handling
 - 3. Calibration of XRF Device Including Substrate Corrections
 - 4. Demonstration of Measurements of Various Materials
 - 5. Use of Survey Meters by Portable Gauge Users.

VII. Q&A SESSION

Course Examination

- 25-50 question, closed-book written test -- 70 percent grade
 - Emphasis on radiation safety of portable gauge storage, use, sealed source location, maintenance, and transportation, rather than the theory and art of making portable gauge measurements; and

- Review of correct answers to missed questions with prospective gauge user immediately following the scoring of the test.

Course Instructor Qualifications

Instructor should have either:

- Bachelor's degree in a physical or life science or engineering;
- Successful completion of a portable gauge user course;
- Successful completion of an 8 hour radiation safety course; and
- 8 hours hands-on experience with portable gauges.

OR

- Successful completion of portable gauge user course;
- Successful completion of 40 hour radiation safety course; and
- 30 hours of hands-on experience with portable gauges.

Note: Licensees should maintain records of training.

Appendix E:

**Typical Duties and Responsibilities of the Radiation
Safety Officer**

The RSO's duties and responsibilities are illustrated in **Figure 3** and typically include ensuring the following:

- Stopping licensed activities that the RSO considers unsafe;
- Possession, use, storage, and maintenance of sources and gauges or XRFs are consistent with the limitations in the license, the Sealed Source and Device Registration sheet(s), and manufacturer's recommendations and instructions;
- Individuals using gauges are properly trained;
- When necessary, personnel monitoring devices are used and exchanged at the proper intervals; records of the results of such monitoring are maintained;
- Gauges or XRFs are properly secured;
- Proper authorities are notified in case of accident, damage to gauges, fire, or theft;
- Unusual occurrences involving the gauge (e.g., accident, damage) are investigated, cause(s) and appropriate corrective action are identified, and corrective action is taken;
- Audits are performed at least annually and documented, and corrective actions taken;
- Licensed material is transported in accordance with all applicable DOT requirements;
- Licensed material is disposed of properly;
- Appropriate records are maintained;
- Up-to-date license is maintained and amendment and renewal requests submitted in a timely manner;
- Up-to-date operating and emergency procedures are developed, maintained, distributed, and implemented;
- Non-routine operations are performed by the manufacturer, distributor, or person specifically authorized by DHFS, NRC or an Agreement State;
- Documentation is maintained to demonstrate, by measurement or calculation, that the TEDE to the individual member of the public likely to receive the highest dose from the licensed operation does not exceed the annual limit in **HFS 157.23(1)**;
- When the licensee identifies rule violations or license conditions or program weaknesses, corrective actions are developed, implemented, and documented; and
- Posting of documents required by **HFS 157.88(1)**.

Appendix F:
Portable Gauge or XF Audit Checklist

NOTE: All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit.

Licensee's name: _____ License No. _____

Auditor: _____ Date of Audit _____ Telephone No. _____

(Signature)

1. AUDIT HISTORY

- a. Last audit of this location conducted on (date) _____
- b. Are previous audits conducted yearly? (*HFS 157.21*)
- c. Are records of previous audits maintained? (*HFS 157.31(2)*)
- d. Are any deficiencies identified during last two audits or two years, whichever is longer?
- e. Are corrective actions taken? (Look for repeated deficiencies).

2. ORGANIZATION AND SCOPE OF PROGRAM

- a. If the mailing address or places of use changed, was the license amended?
- b. If ownership changed or bankruptcy filed, was DHFS prior consent obtained or was DHFS notified?
- c. If the RSO was changed, was license amended? Does new RSO meet DHFS training requirements?
- d. If the designated contact person changed, was DHFS notified?
- e. Does the license authorize all of the DHFS regulated radionuclides contained in the gauges?
- f. Are the gauges or XRFs as described in the Sealed Source and Device (SSD) Registration Certificate or Sheet? Have copies of (or access to) SSD Certificates? Have manufacturers' manuals for operation and maintenance?
- g. Are the actual uses of gauges consistent with the authorized uses listed on the license?
- h. Is RSO fulfilling his/her duties?

3. TRAINING AND INSTRUCTIONS TO WORKERS

- a. Are all workers who are likely to exceed 100 mrem (1 mSv) in a year given training annually per (*HFS 157.88 (2)?A*)
- b. Did each gauge or XRF operator attend an approved course prior to using gauges?
- c. Are training records maintained for each gauge or XRF operator?
- d. Did interviews with operators reveal that they know the emergency procedures?
- e. Did this audit include observations of operators using the gauge or XRF in a field situation? Operating gauge or XRF? Performing routine cleaning and lubrication? Transporting gauge or XRF? Storing gauge or XRF?
- f. Did the operator demonstrate safe handling and security during transportation, use and storage?

- g. HAZMAT training provided as required? [*49 CFR 172.700, 49 CFR 172.701, CFR 172.702, 49 CFR 172.703, 49 CFR 172.704*]

4. RADIATION SURVEY INSTRUMENTS (For Portable Gauges Users Only)

- a. Does the licensee possess a survey meter? (*HFS 157.05(2)(b)*)
- b. Is a survey meter available for use at each job site? (*HFS 157.05(2)(b)*)
- c. Is the survey meter needed for non-routine maintenance calibrated as required (*HFS 157.25 (1)*)?
- d. Are calibration records maintained (*HFS 157.31 (3)*)?

5. GAUGE AND XRF INVENTORY

- a. Is a record kept showing the receipt of each gauge or XRF? (*HFS 157.31*)
- b. Are all gauges or XRFs received physically inventoried every 6 months?
- c. Are records of inventory results with appropriate information maintained?

6. PERSONNEL RADIATION PROTECTION

- a. Are ALARA considerations incorporated into the radiation protection program? (*HFS 157.21*)
- b. Is documentation kept showing that unmonitored XRF users receive <10% of limit? (Portable gauges users are required to have dosimetry)
- c. Did unmonitored users' activities change during the year which could put them over 10% of limit?
- d. If yes to c. above, was a new evaluation performed?
- e. Is external dosimetry required (Portable gauges users are required to have and XRF users receiving >10% of limit are required to have)? And is dosimetry provided to users?
 - 1) Is the dosimetry supplier *NVLAP* approved? (*HFS 157.25(1)*)
 - 2) Are the dosimeters exchanged monthly for film badges and at industry recommended frequency for TLDs?
 - 3) Are dosimetry reports reviewed by the RSO when they are received?
 - 4) Are the records DHFS Forms or equivalent? (*HFS 157.31 (5) and (7)*)
 - DHFS *DPH 45003* "Occupational Exposure Record for a Monitoring Period" completed?
 - 5) If a worker declared her pregnancy, did licensee comply with (*HFS 157.22(8)*)? Are records kept of embryo/fetus dose per (*HFS 157.31 (7)*)?
- f. Are records of exposures, surveys, monitoring, and evaluations maintained? (*HFS 157.31 (2-3) and (7)*)

7. PUBLIC DOSE

- a. Are gauges or XRFs stored in a manner to keep doses below 100 mrem (1 mSv) in a year? (*HFS 157.23 (1)*)
- b. Has a survey or evaluation been performed per *HFS 157.25 (1)*? Have there been any additions or changes to the storage, security, or use of surrounding areas that would

necessitate a new survey or evaluation?

- c. Do unrestricted area radiation levels exceed 2 mrem (0.02 mSv) in any one hour? (**HFS 157.23 (1)**)
- d. Are gauges or XRFs being stored in a manner that would prevent unauthorized use or removal?
(**HFS 157.28 (1) (a)**)
- e. Records maintained? (**HFS 157.31 (3) and (8)**)

8. OPERATING AND EMERGENCY PROCEDURES

- a. Have operating and emergency procedures been developed?
- b. Do they contain the required elements?
- c. Does each operator have a current copy (telephone numbers) of the operating and emergency procedures?

9. LEAK TESTS

- a. Was each sealed source leak tested every 6 months or at other prescribed intervals?
- b. Was the leak test performed as described in correspondence with DHFS and according to the license?
- c. Are records of results retained with the appropriate information included?
- d. Are any sources found leaking and if yes, was DHFS notified?

10. MAINTENANCE OF GAUGES or XRFs

- a. Are manufacturer's procedure followed for routine cleaning and lubrication of gauge and XRF?
- b. Does the source or source rod remain attached to the portable gauge or XRF during cleaning?
- c. Is non-routine maintenance performed where the source or source rod is detached from the gauge or XRF? If yes, was it performed according to license requirements (e.g., extent of work, individuals performing the work, procedures, dosimetry, survey instrument, compliance with **HFS 157.13 (1)** limits)? (*Applies only to Portable Gauge Users, XRF users are not allowed to perform non-routine maintenance.*)

11. TRANSPORTATION

Portable Gauges

- a. DOT-7A or other authorized packages used? (**49 CFR 173.415, 49 CFR 173.416(b)**)
- b. Package performance test records on file?
- c. Special form sources documentation? (**49 CFR 173.476(a)**)
- d. Package has 2 labels (ex. Yellow-II) with TI, Nuclide, Activity, and Hazard Class? (**49 CFR 172.403, 49 CFR 173.441**)
- e. Package properly marked? (**49 CFR 172.301, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324**)
- f. Package closed and sealed during transport? (**49 CFR 173.475(f)**)
- g. Shipping papers prepared and used? (**49 CFR 172.200(a)**)
- h. Shipping papers contain proper entries? {Shipping name, Hazard Class, Identification Number (UN Number), Total Quantity, Package Type, Nuclide, RQ, Radioactive Material, Physical and Chemical Form, Activity, category of label, TI, Shipper's Name, Certification

and Signature, Emergency Response Phone Number, Cargo Aircraft Only (if applicable)} (*49 CFR 172.200, 49 CFR 172.201, 49 CFR 172.202, 49 CFR 172.203, 49 CFR 172.204, 49 CFR 172.604*)

- i. Shipping papers within drivers reach and readily accessible during transport? (*49 CFR 177.817(e)*)
- j. Secured against movement? (*49 CFR 177.834*)
- k. Placarded on vehicle, if needed? (*49 CFR 172.504*)
- l. Proper overpacks, if used? (*49 CFR 173.25*)
Any incidents reported to DOT? (*49 CFR 171.15, 16*)

XRF

- a. If shipping papers are not required, is there a certification statement (*49 CFR 173.422(a)(2)*) along with the name of the consignor or consignee included with (on the package or inside the package) the XFR when transported?

12. AUDITOR'S INDEPENDENT SURVEY MEASUREMENTS (IF MADE)

- a. Describe the type, location, and results of measurements. Do any radiation level exceed regulatory limits?.

13. NOTIFICATION AND REPORTS

- a. Was any radioactive material lost or stolen? Are reports made? (*HFS 157.32*)
- b. Did any reportable incidents occur? Are reports made? (*HFS 157.32*)
- c. Did any overexposures and high radiation levels occur? Reported? (*HFS 157.32*)
- d. If any events (as described in items a through c above) did occur, what was root cause? Are corrective actions appropriate?
- e. Is the licensee aware of telephone number for radiation emergencies in the State of Wisconsin? (**608**) **258-0099**

14. POSTING AND LABELING

- a. DHFS-PPH 45025 "Notice to Employees" posted? (*HFS 157.88 (1)*)
- b. **Chapter HFS 157 'Radiation Protection', Subchapter 3 and 10**, license documents posted or a notice posted? (*HFS 157.88 (1)*)
- c. Any notice of violation, forfeiture assessment or order issued under *s. 254.37 or 254.45, Stats.*, or **Chapter HFS 157 'Radiation Protection'** and any response from the licensee or registrant is posted until removal is authorized by DHFS? (*HFS 157.88(1)*)
- d. Emergency procedures that apply to activities conducted under the license posted? (*HFS 157.88(1)*).
- e. Other posting and labeling? (*HFS 157.29(2) and (4)*)

15. RECORD KEEPING FOR DECOMMISSIONING

- a. Records kept of information important to decommissioning? (*HFS 157.15*)
- b. Records include all information outlined (*HFS 157.15*)

16. BULLETINS AND INFORMATION NOTICES

- a. Are Information Notices received?

- b. Appropriate training and action taken in response?

17. SPECIAL LICENSE CONDITIONS OR ISSUES

- a. Did auditor review special license conditions or other issues (e.g., non-routine maintenance)?

18. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS

- a. Summarize problems/deficiencies identified during audit.
- b. If problems/deficiencies identified in this audit, describe corrective actions planned or taken. Are corrective actions planned or taken at ALL licensed locations (not just location audited)?
- c. Provide any other recommendations for improvement.

19. EVALUATION OF OTHER FACTORS

- a. Senior licensee management is appropriately involved with the radiation protection program and/or RSO oversight?
- b. RSO has sufficient time to perform his/her radiation safety duties?
- c. Licensee has sufficient staff to support the radiation protection program?

Appendix G:

Information Needed to Support a Portable Gauge Licensee's Request to Perform Non-routine Maintenance

Non-routine maintenance or repair (beyond routine cleaning and lubrication) involves detaching the source or source rod from the device and any other activities during which personnel could receive radiation doses exceeding DHFS limits. See **Figure 9**. If this maintenance or repair is not performed properly with attention to good radiation safety principles, the gauge may not operate as designed and personnel performing these tasks could receive radiation doses exceeding DHFS limits.

A typical moisture-density gauge contains 0.37 gigabecquerels (10 millicuries) of cesium-137 and 1.5 gigabecquerels (40 millicuries) of americium-241 as a neutron source. In about 9 minutes, an unshielded cesium-137 source of this activity can deliver 0.05 sievert (5 rems) to a worker's hands or fingers (i.e., extremities), assuming the extremities are 1 centimeter from the source. Some gauges contain sources of even higher activities with correspondingly higher dose rates. The threshold for extremity monitoring is 0.05 sievert (5 rems) per year.

Thus, applicants wishing to perform non-routine maintenance must use personnel with special training and follow appropriate procedures consistent with the manufacturer's instructions and recommendations that address radiation safety concerns (e.g., use of radiation survey meter, shielded container for the source, personnel dosimetry). Accordingly, provide the following information:

- Describe the types of work, maintenance, cleaning, repair, etc., to be performed that necessitate detaching the source or source rod from the device or that could cause personnel to receive radiation doses exceeding DHFS limits. The principal reason for obtaining this information is to assist in the evaluation of the qualifications of individuals who will conduct the work and the radiation safety procedures they will follow.
- Identify who will perform non-routine maintenance, their training and experience, and why they are competent to perform non-routine maintenance.
- Submit procedures for safe handling of the radioactive source while the source or source rod is detached from the gauge. These procedures should ensure the following:
 - doses to personnel and members of the public are within regulatory limits and ALARA (e.g., use of shielded containers or shielding);
 - the source or source rod is secured against unauthorized removal access or under constant surveillance;
 - appropriate labels and signs are used; and
 - manufacturer's instructions and recommendations are followed.
- Confirm that individuals performing non-routine maintenance on gauges will always are both whole body and extremity monitoring devices or that an evaluation will be available to demonstrate that these individuals are not likely to receive, in one year, more than 10 percent of the applicable dose limits. The dose limits are illustrated in **Figure 5**.

- Verify possession of at least one survey instrument meeting the following criteria:
 - Be capable of detecting gamma radiation;
 - Be capable of measuring from 0.01 to 0.5 mSv/hr [1 to 50 mrem/hr];
 - Be calibrated at least annually with radionuclide point sources emitting radiation of the type and energy of the sealed sources in the gauge;
 - Be calibrated at least 2 points located at approximately 1/3 and 2/3 of each scale; readings within $\pm 20\%$ are acceptable;
 - Be calibrated by a person specifically licensed by DHFS, the NRC, or an Agreement State to calibrate radiation detection instruments; and
 - Be checked for functionality prior to use (e.g., with the gauge or a check source).

Note: Records of instrument calibration must be maintained for 3 years after the record is made (**HFS 157.31 (3)**).

- Describe steps to be taken to ensure that radiation levels in areas where non-routine maintenance will take place do not exceed **HFS 157.23(1)** limits. For example, applicants can do the following:
 - commit to performing surveys with a survey instrument (as described above);
 - specify where and when surveys will be conducted during non-routine maintenance; and
 - commit to maintaining, for 3 years from the date of the survey, records of the survey (e.g., who performed the survey, date of the survey, instrument used, measured radiation levels correlated to location of those measurements), as required by **HFS 157.31 (3)**.

Appendix H:

Operating and Emergency Procedures

Operating Procedures

- If personnel dosimetry is provided:
 - Always wear your assigned thermoluminescent dosimeter (TLD), OSL or film badge when using the gauge or XRF;
 - Never wear another person's TLD, OSL or film badge; and
 - Never store your TLD, OSL or film badge near the gauge or XRF.
- Before removing the gauge or XRF from its place of storage, ensure that, where applicable, each gauge source is in the fully shielded position and that in gauges with a movable rod containing a sealed source, the source rod is locked (e.g., keyed lock, padlock, mechanical control) in the shielded position. Place the gauge in the transport case and lock the case.
- Sign out the gauge or XRF in a log book (that remains at the storage location) including the date(s) of use, name(s) of the authorized users who will be responsible for the gauge, and the temporary jobsite(s) where the gauge will be used.
- Block and brace the gauge to prevent movement during transport and lock the gauge in or to the vehicle. Follow all applicable Department of Transportation (DOT) requirements when transporting the gauge.
- Use the gauge or XRF according to the manufacturer's instructions and recommendations.
- Do not touch the unshielded source rod with your fingers, hands, or any part of your body.
- Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded source.
- Perform routine cleaning and maintenance according to the manufacturer's instructions and recommendations.
- When the gauge or XRF is not in use at a temporary jobsite, place the gauge or XRF in a secured location (e.g., locked in the trunk of a car or locked in a storage shed).
- Prior to transporting the gauge or XRF, ensure that, where applicable, each gauge source is in the fully shielded position. Ensure that in gauges with a movable source rod, the source rod is locked in the shielded position (e.g., keyed lock, padlock, mechanical control). Place the gauge in the transport case and lock the case. Block and brace the case to prevent movement during transportation. Lock the case in or to the vehicle.
- Return the gauge or XRF to its proper locked storage location at the end of the work shift.
- Log the gauge or XRF into the daily use log when it is returned to storage.
- After making changes affecting the gauge storage area (e.g., changing the location of gauges within the storage area, removing shielding, adding gauges or XRFs, changing the occupancy of adjacent areas, moving the storage area to a new location), reevaluate compliance with public dose limits and ensure proper security of gauges or XRFs.

For Portable Gauges Only

- Unless absolutely necessary, do not look under the gauge when the source rod is being lowered into the ground. If you must look under the gauge to align the source rod with the hole, follow the manufacturer's procedures to minimize radiation exposure.
- After completing each measurement in which the source is unshielded, immediately return the source to the shielded position.
- Always maintain constant surveillance and immediate control of the gauge when it is not in storage. At job sites, do not walk away from the gauge when it is left on the ground. Take actions necessary to protect the gauge and yourself from danger of moving heavy equipment.
- Always keep unauthorized persons away from the gauge.
- If gauges are used for measurements with the unshielded source extended more than 3 feet beneath the surface, use piping, tubing, or other casing material to line the hole from the lost depth to 12 inches above the surface. If the piping, tubing, or other casing material cannot extend 12 inches above the surface, cap the hole liner or take other steps to ensure that the hole is free of debris (and it is unlikely that debris will re-enter the cased hole) so that the unshielded source can move freely (e.g., use a dummy probe to verify that the hole is free of obstructions).

Emergency Procedures for Portable Gauges:

If the source fails to return to the shielded position (e.g., as a result of being damaged, source becomes stuck below the surface) or if any other emergency or unusual situation arises (e.g., the gauge is struck by a moving vehicle, is dropped, is in a vehicle involved in an accident):

- Immediately secure the area and keep people at least 15 feet away from the gauge until the situation is assessed and radiation levels are known. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.
- If any heavy equipment is involved, detain the equipment and operator until it is determined there is no contamination present.
- Gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.
- Notify the persons in the order listed below of the situation:

NAME*	WORK PHONE NUMBER*	HOME PHONE NUMBER*

* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the *RSO*, or other knowledgeable licensee staff, licensee's consultant, gauge manufacturer) to be contacted in case of emergency.

- Follow the directions provided by the person contacted above.

Emergency Procedures for XRFs.

If the XRF is lost, damaged or stolen, or if any other emergency or other unusual event occurs arises:

- Immediately secure the area and keep people at least 15 feet away from the XRF until the situation is assessed and radiation levels are known. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.
- XRF users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.
- Notify the persons in order listed below of the situation:

NAME*	WORK PHONE NUMBER*	HOME PHONE NUMBER*

* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the **RSO**, or other knowledgeable licensee staff, licensee's consultant, XRF manufacturer) to be contacted in case of emergency.

- Follow the directions provided by the person contacted above.

RSO and Licensee Management:

- Arrange for a radiation survey to be conducted as soon as possible by a knowledgeable person using appropriate radiation detection instrumentation. This person could be a licensee employee using a survey meter located at the jobsite or a consultant. To accurately assess the radiation danger, it is essential that the person performing the survey be competent in the use of the survey meter.
- If portable gauges are used for measurements with the unshielded source extended more than 3 feet below the surface, contact persons listed on the emergency procedures need to know the steps to be followed to retrieve a stuck source and to convey those steps to the staff on site.
- Make necessary notifications to local authorities as well as DHFS required. (Even if not required to do so, you may report ANY incident to DHFS by calling **(608) 258-0099**, which is staffed 24 hours a day and accepts collect calls.) DHFS notification is required when gauges containing licensed material are lost or stolen, when gauges are damaged or involved in incidents that result in doses in excess of **HFS 157.32 (3)** limits, and when it becomes apparent that attempts to recover a source stuck below the surface will be unsuccessful.
- Notify law enforcement if the gauge or XRF is believed to be lost or stolen.
- Reports to DHFS must be made within the reporting timeframes specified by **Chapter HFS 157 'Radiation Protection.'**

Reporting requirements are found in **HFS 157.32 (1-3); and HFS 157.32.**

Appendix I:

Dosimetry-related Guidance

Part 1: Worksheet for Determining if Personnel Dosimetry is Required for XRF Users

WORKSHEET FOR DETERMINING IF PERSONNEL DOSIMETRY IS REQUIRED FOR XRF USERS

Instructions: To meet the requirement of *HFS 157.25(2)(a)* complete **Steps 1** through **6** and sign and date the evaluation on the line provided.

Disclaimer: If there is a change in workload or if a new source (new XRF) is acquired a new evaluation will need to be performed.

Step 1.

Determine the radiation level while the shutter is open in one of the following ways. Record the results below.

- Obtain from the manufacturer's specifications: the radiation level approximately 30 centimeters from the XRF when shutter is open, or
- Measure the radiation level with a calibrated survey meter.
 - When making the radiation measurement while the shutter is open, place the survey instrument approximately 30 centimeters from the XRF while following good radiation safety practices.

_____ mrem per hour

Step 2.

Record the average number of minutes per week that the XRF is used with the shutter in open position.

_____ minutes per week

Step 3.

Divide the minutes per week (**Step 2.**) by 60 to determine hours per week and record below.

_____ minutes per week (**Step 2.**) / 60

= _____ hours per week

Step 4.

Multiply the hours per week (**Step 3.**) by 52 weeks to equal hours per year and record below.

_____ hours per week (**Step 3.**) X 52 weeks

= _____ hours per year

Step 5.

Multiply hours per year (**Step 4.**) by mrem per hour (**Step 1.**) to equal mrem received per year and record below.

_____ hours per year (**Step 4.**) X _____ mrem per hour (**Step 1.**)

= _____ mrem per year

Step 6.

Is the # of mrem per year (**Step 5.**) greater than 500? ☐ Yes ☐ No

- If yes provide dosimetry as required by **HFS 157.25(2)(a)1**

- If no, proceed to **Step 7.**

Step 7.

Is the # of mrem per year (**Step 5.**) greater than 100? ☐ Yes ☐ No

- If yes, and you have an employee that is a declared pregnant worker as defined by **HFS 157.03(90)** provide dosimetry to that individual. In addition, provide annual radiation safety training as required by **HFS 157.88(2)** to all employees that use the XRF.

- If no, you are not required under **Wisconsin Administrative Code Chapter HFS 157 'Radiation Protection'** to provide dosimetry to your employees.

*Signature of Person Performing the
Evaluation*

Date

**Part 2: Guidance for Demonstrating that Individual
Members of the Public will not Receive Doses Exceeding
the Allowable Limit**

Licensees must ensure that:

- The radiation dose received by individual members of the public does not exceed 1 mSv (100 mrem) in one calendar year resulting from the licensee's possession and/or use of licensed materials.

Members of the public include persons who live, work, or may be near locations where portable gauges or XRFs are used or stored. (For storage of gauges in personal residences, occupants are considered members of the public.) Employees whose assigned duties do not include the use of licensed materials but who work in the vicinity where gauges or XRFs are used or stored are also considered members of the public.

- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.

Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and non-radioactive equipment storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons such as security.

Licensees must show compliance with both portions of the rule. Calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance.

Calculational Method

The calculational method takes a tiered approach, going through a three-part process starting with a worst case situation and moving toward more realistic situations. It makes the following simplifications: (1) each gauge is a point source, (2) typical radiation levels encountered when the source is in the shielded position are taken from either the SSD Registration Sheet or the manufacturer's literature, and (3) no credit is taken for any shielding found between the gauges and the unrestricted areas.

Part 1 of the calculational method is simple but conservative. It assumes that an affected member of the public is present 24 hours a day and uses only the "inverse square law" to determine if the distance between the gauge and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that the affected member of the public is actually in the area under consideration. Part 3 considers distance and the portion of time that both the gauge and the affected member of the public are present. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases licensees will need to use the calculational method through Part 1 or Part 2. The results of these calculations typically result in higher

radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses which could be received.

Example 1

To better understand the calculational method, will look at Moisture-Density Measurements, Inc., a portable gauge licensee. Yesterday, the company's president noted that the new gauge storage area is very close to his secretary's desk and he asked Joe, the RSO, to determine if the company is complying with **Chapter HFS 157 'Radiation Protection.'**

The secretary's desk is near the wall separating the reception area from the designated, locked gauge storage area, where the company is storing its three gauges. Joe measures the distances from each gauge to the wall and looks up in the manufacturer's literature the radiation levels individuals would encounter for each gauge. **Figure 11** is Joe's sketch of the areas in question, and **Table 2** summarizes the information Joe has on each gauge.

A Bird's Eye View of Office and Gauge Storage Area

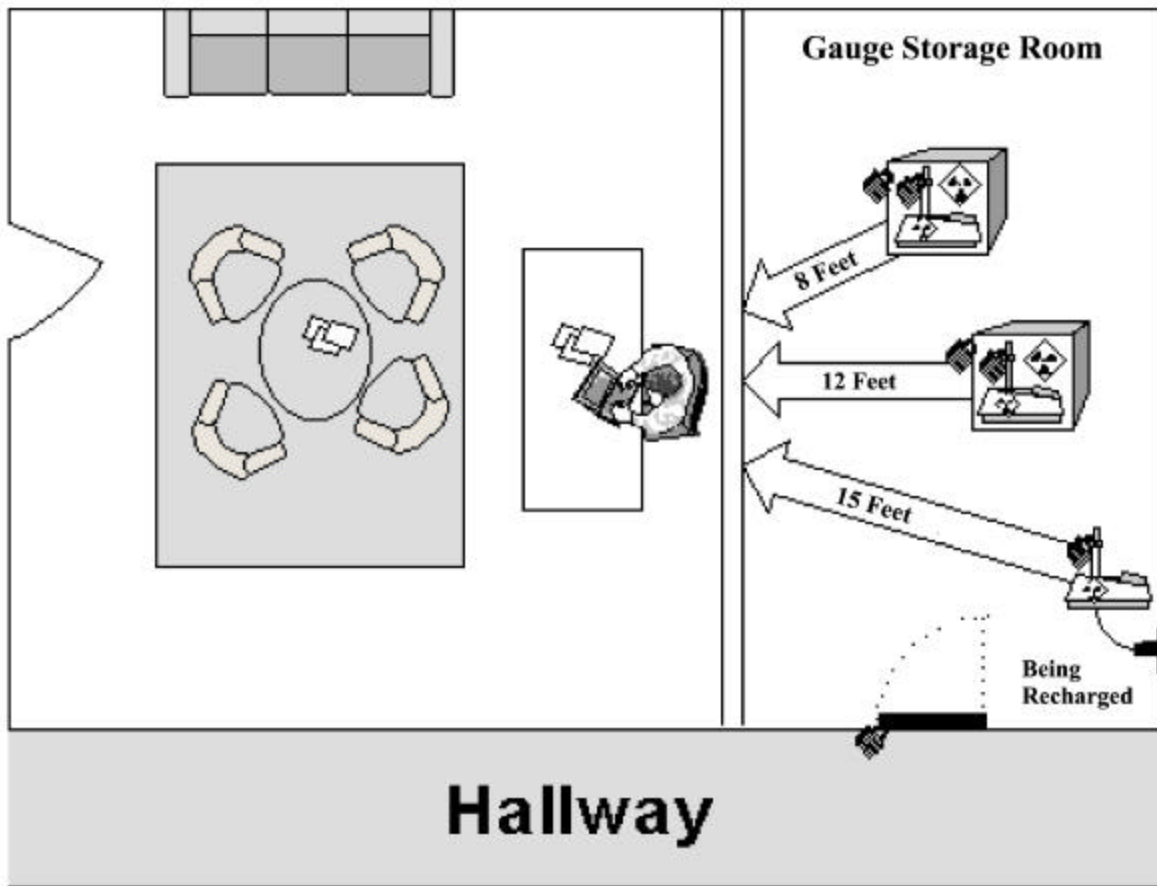


Figure 11. *Diagram of Office and Gauge Storage Area.* This sketch shows the areas described in Examples 1 and 2.

Table 2. Information Known about Each Gauge

DESCRIPTION OF KNOWN INFORMATION	GAUGE 1	GAUGE 2	GAUGE 3
How gauge is stored	Gauge in transport container	Gauge in transport container	Gauge out of transport container and being recharged
Dose rate in mrem/hr encountered at specified distance from the gauge (from manufacturer's literature)	2 mrem/hr at 1 ft	8 mrem/hr at 1 ft	2 mrem/hr at 3 ft
Distance in ft to secretary's chair	8 ft	12 ft	15 ft

Example 1: Part 1

Joe's first thought is that the distance between the gauges and the secretary's chair may be sufficient to show compliance with the rule in *HFS 157.23 (1)*. So, taking a "worst case" approach, he assumes: 1) the gauges are constantly present (i.e., 24 hr/d), 2) all three gauges remain in storage with no other use, and 3) the secretary is constantly sitting in the desk chair (i.e., 24 hr/d). Joe proceeds to calculate the dose she might receive hourly and yearly from each gauge as shown in **Tables 3, 4, and 5** below.

Table 3. Calculational Method, Part 1---Hourly and Annual Dose Received from Gauge 1

		GAUGE 1	
Step No.	Description	Input Data	Results
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft ²	(1) ²	1
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft ²	(8) ²	64
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 1 = 2	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM GAUGE 1 , in mrem in an hour.	2/64 = 0.031	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 1 , in mrem in a year.	0.031 x 24 x 365 = 0.031 x 8760 = 272	

Table 4. Calculational Method, Part 1---Hourly and Annual Dose Received from Gauge 2

		GAUGE 2	
Step No.	Description	Input Data	Results
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	8	8
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft ²	(1) ²	1
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft ²	(12) ²	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	8 x 1 = 8	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in an hour by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM GAUGE 2 , in mrem in an hour	8/144 = .056	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 2 , in mrem in a year	0.056 x 24 x 365 = 0.056 x 8760 = 491	

Table 5. Calculational Method, Part 1---Hourly and Annual Dose Received from Gauge 3

		GAUGE 3	
Step No.	Description	Input Data	Results
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft ²	(3) ²	9
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft ²	(15) ²	225
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 9 = 18	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received by an individual at the secretary's desk, HOURLY DOSE RECEIVED FROM GAUGE 3 , in mrem in an hour	18/225 = 0.08	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 3 , in mrem in a year	0.08 x 24 x 365 = 0.08 x 8760 = 701	

To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.

Table 6. Calculational Method, Part 1---Total Hourly and Annual Dose Received from Gauge 1, 2, and 3

Step No.	Description	Gauge 1	Gauge 2	Gauge 3	Sum
7	TOTAL HOURLY DOSE RECEIVED from Step 5 of Tables I-3, I-4, and I-5, in mrem in an hour	0.031	0.056	0.08	0.031 + 0.056 + 0.08 = 0.167
8	TOTAL ANNUAL DOSE RECEIVED from Step 6 of Tables I-3, I-4, and I-5, in mrem in a year	272	491	701	272 + 491 + 701 = 1464

NOTE: The Sum in Step 7 demonstrates compliance with the 2 mrem in any one hour limit. Reevaluate if assumptions change. If the Sum in Step 8 exceeds 100 mrem/yr, proceed to Part 2 of the calculational method.

At this point, Joe is pleased to see that the total dose that an individual could receive in any one hour is only 0.167 mrem, but notes that an individual could receive a dose of 1,464 mrem in a year, much higher than the 100 mrem limit.

Example 1: Part 2

Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hr/d. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his

other assumptions constant (i.e., the gauges are constantly present (i.e., 24 hr/d), all three gauges remain in storage with no other use). He then recalculates the annual dose received.

Table 7. Calculational Method, Part 2--Annual Dose Received from Gauges 1, 2, and 3

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 hr/day; the remainder of the day the secretary is away from the desk area copying, filing, etc.)	5
	B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week)	3
	C. Average number of weeks per year in area (e.g., secretary works all year)	52
10	Multiply the results of Step 9.A. by the results of Step 9.B. by the results of Step 9.C. = AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR	$5 \times 3 \times 52$ = 780
11	Multiply the sum in Step 7 by the results of Step 10 = ANNUAL DOSE RECEIVED FROM GAUGES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN , in mrem in a year	$0.167 \times 780 = 130$

NOTE: If Step 11 exceeds 100 mrem in a year, proceed to Part 3 of the calculational method.

Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the 100 mrem in a year limit.

Example 1, Part 3

Again Joe reviews his assumptions and recognizes that the gauges are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each gauge individually.

Table 8. Calculational Method, Part 3---Summary of Information

INFORMATION ON WHEN GAUGES ARE PRESENT IN THE STORAGE AREA:

- **GAUGE 1:** an old gauge located in the storage area continuously (24 hr/d)
- **GAUGE 2:** a new gauge located in the storage area continuously (24 hr/d) for 8 months of the year; for the remaining 4 months of the year it is at temporary job sites
- **GAUGE 3:** a new gauge located in the storage area overnight; it is used every day at temporary job sites all year and returned to the storage location at the end of each day. The gauge is usually present during the secretary's first and last hours of work each day.

INFORMATION FROM EXAMPLE 1, PART 2 ON WHEN THE SECRETARY IS SITTING AT THE DESK

- **5 hours per day**
- **3 days per week**
- **52 weeks per year**

Table 9. Calculational Method, Part 3---Annual Dose Received from Gauges 1, 2, and 3

Step No.	Description	GAUGE 1	GAUGE 2	GAUGE 3
12	Average number of hours per day gauge is in storage while secretary is present	5	5	2
13	Average number of days per week gauge is in storage while secretary is present	3	3	3
14	Average number of weeks per year gauge is in storage while secretary is present	52	32	52
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = TOTAL HOURS EACH GAUGE IS STORED PER YEAR WHILE SECRETARY IS PRESENT	$5 \times 3 \times 52 =$ 780	$5 \times 3 \times 32 =$ 480	$2 \times 3 \times 52 =$ 312
16	Multiply the results of Step 15 by the results of Step 7 = ANNUAL DOSE RECEIVED FROM EACH GAUGE , in mrem in a year	$780 \times 0.031 =$ 24	$480 \times 0.056 =$ 27	$312 \times 0.08 =$ 25
17	Sum the results of Step 16 for each gauge = TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME GAUGE IS IN STORAGE , in mrem in a year	$24 + 27 + 25 =$ 76		

NOTE: If the result in Step 17 is greater than 100 mrem/yr, the licensee must take corrective actions.

Joe is pleased that the result in Step 17 shows compliance with the 100 mrem/yr limit. Had the result in Step 17 been higher than 100 mrem/yr, then Joe could have done one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each gauge is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions;
- Calculate the effect of any shielding located between the gauge storage area and the secretarial workstation--such calculation is beyond the scope of this Appendix;
- Take corrective action (e.g., move gauges within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance; and
- Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary as required by *HFS 157.88 (2)*.

Note that in the example, Joe evaluated the unrestricted area outside only one wall of the gauge storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the **ALARA** principle, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the gauges closer to the secretarial workstation, adding a gauge to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

RECORD KEEPING: *HFS 157.31(8)* requires licensees to maintain records demonstrating compliance with the dose limits for individual members of the public.

Combination Measurement-Calculational Method

This method, which allows the licensee to take credit for shielding between the gauge and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each gauge. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making measurements with currently calibrated radiation survey instruments. A maximum dose of 1 mSv (100 mrem) received by an individual over a period of 2080 hours (i.e., a "work" year of 40 hr/wk for 52 wk/yr) is equal to less than 0.5 microsievert (0.05 mrem) per hour.

This rate is well below the minimum sensitivity of most commonly available G-M survey instruments.

Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector (e.g., NaI(Tl)) or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLDs in unrestricted areas next to the gauge storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 1 mSv/yr (100 mrem/yr) limit.

Note: TLDs used for personnel monitoring (e.g., LiF) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv (10 mrem). Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv (120 mrem), a value in excess of the 1 mSv/yr (100 mrem/yr) limit. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing CaF_2 that are used for environmental monitoring.

Example 2

As in Example 1, Joe is the RSO for Moisture-Density Measurements, Inc., a portable gauge licensee. The company has three gauges stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial work station is located. See **Figure 11** and **Table 2** for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

During the winter while all the gauges re in storage, Joe placed an environmental TLD badge in the secretarial workspace for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each gauge was in the storage area. The TLD processor sent Joe a report indicating the TLD received 100 mrem.

Table 10. Combination Measurement-Calculation Method

Step No.	Description	Input Data and Results
PART 1		
1	Dose received by <i>TLD</i> , in mrem	100
2	Total hours <i>TLD</i> exposed	24 hr/d x 30 d/mo = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED , in mrem in an hour	0.14
4	Multiply the results of Step 3 by 365 d/yr x 24 hr/d = 8760 hours in one year = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGES , in mrem in a year	365 x 24 x 0.14 = 8760 x 0.14 = 1226

NOTE: For the conditions described above, Step 3 indicates that the dose received in any one hour is less than the 2 mrem in any one hour limit. However, if there are any changes, then the licensee would need to reevaluate the potential doses which could be received in any one hour. Step 4 indicates that the annual dose received would be much greater than the 100 mrem in a year allowed by the rule.

PART 2

At this point Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

PART 3

If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the gauges are actually in storage as in Part 3 of Example 1. (Recall that the *TLD* measurement was made while all the gauges re in storage--i.e., 24 hr/d for the 30 days that the *TLD* was in place.)

Appendix J:
Requests to Perform Leak Testing and Sample Analysis

Leak Test Program

Training

Before allowing an individual to perform leak testing, the RSO will ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak tests independently.

Classroom training may be in the form of lecture, videotape, or self-study, and will cover the following subject areas:

- Principles and practices of radiation protection;
- Radioactivity measurements, monitoring techniques, and the use of instruments;
- Mathematics and calculations basic to the use and measurement of radioactivity; and
- Biological effects of radiation.

Appropriate on-the-job-training consists of:

- Observing authorized personnel collecting and analyzing leak test samples;
- Collecting and analyzing leak test samples under the supervision and in the physical presence of an individual authorized to perform leak tests.

Facilities and Equipment

- To ensure achieving the required sensitivity of measurements, leak tests will be analyzed in a low-background area.
- Individuals conducting leak tests will use a calibrated and operable survey instrument to check leak test samples for gross contamination before they are analyzed.
- An NaI(Tl) well counter system with a single or multichannel analyzer will be used to count samples from gauges containing gamma-emitters (e.g., Cs-137, Co-60).
- A liquid scintillation or gas-flow proportional counting system will be used to count samples from gauges containing beta-emitters (e.g., Sr-90) or alpha emitters (e.g., Am-241).

Frequency for Conducting Leak Tests of Sealed Sources

- Leak tests will be conducted at the frequency specified in the respective SSD Registration Certificate.

Procedure for Performing Leak Testing and Analysis

- For each source to be tested, list identifying information such as gauge serial number, radionuclide, activity.
- If available, use a survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.
- Wipe the most accessible area where contamination would accumulate if the sealed source re leaking.
- Select an instrument that is sensitive enough to detect 185 Bq (0.005 microcurie) of the radionuclide contained in the gauge.
- Using the selected instrument, count and record background count rate.

- Check the instrument's counting efficiency using standard source of the same radionuclide as the source being tested or one with similar energy characteristics. Accuracy of standards should be within +/-5 percent of the stated value and traceable to a primary radiation standard such as those maintained by the National Institutes of Standards and Technology (NIST).
- Calculate efficiency.

For example:
$$\frac{[(\text{cpm from std}) - (\text{cpm from bkg})]}{\text{activity of std in Bq}} = \text{efficiency in cpm/Bq}$$

where: cpm = counts per minute
 std = standard
 bkg = background
 Bq = Becquerel

- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in Bq (or microcuries).

For example:
$$\frac{[(\text{cpm from wipe sample}) - (\text{cpm from bkg})]}{\text{efficiency in cpm/Bq}} = \text{Bq on wipe sample}$$

- Sign and date the list of sources, data, and calculations. Retain records for 3 years.
- If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the RSO so that the source can be withdrawn from use and disposed of properly. Also notify DHFS.

Appendix K:
Major DOT Regulations; Sample Bill of Lading

The major areas in the DOT regulations that are most relevant for transportation of typical portable gauges that are shipped as Type A quantities are as follows:

- Table of Hazardous Materials and Special Provisions **49 CFR 172.101**, and App. A, Table 2: Hazardous materials table, list of hazardous substances and reportable quantities
- Shipping Papers **49 CFR 172.200-204**: general entries, description, additional description requirements, shipper's certification
- Package Markings **49 CFR 172.300, 49 CFR 172.301, 49 CFR 172.303, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324**: General marking requirements for non-bulk packagings, prohibited marking, marking requirements, radioactive material, hazardous substances in non-bulk packaging
- Package Labeling **49 CFR 172.400, 49 CFR 172.401, 49 CFR 172.403, 49 CFR 172.406, 49 CFR 172.407, 49 CFR 172.436, 49 CFR 172.438, 49 CFR 172.440**: General labeling requirements, prohibited labeling, radioactive materials, placement of labels, specifications for radioactive labels
- Placarding of Vehicles **49 CFR 172.500, 49 CFR 172.502, 49 CFR 172.504, 49 CFR 172.506, 49 CFR 172.516, 49 CFR 172.519, 49 CFR 172.556**: Applicability, prohibited and permissive placarding, general placarding requirements, providing and affixing placards: highway, visibility and display of placards, RADIOACTIVE placard
- Emergency Response Information, Subpart G, **49 CFR 172.600, 49 CFR 172.602, 49 CFR 172.604**: Applicability and general requirements, emergency response information, emergency response telephone number
- Training, Subpart H, **49 CFR 172.702, 49 CFR 172.704**: Applicability and responsibility for training and testing, training requirements
- Radiation Protection Program for Shippers and Carriers, Subpart I, **49 CFR 172.800**, etc.
- Shippers - General Requirements for Shipments and Packaging, Subpart I, **49 CFR 173.403, 49 CFR 173.410, 49 CFR 173.412, 49 CFR 173.415, 49 CFR 173.433, 49 CFR 173.435, 49 CFR 173.441, 49 CFR 173.475, 49 CFR 173.476**: Definitions, general design requirements, additional design requirements for Type A packages, authorized Type A packages, requirement for determining A_1 and A_2 , table of A_1 and A_2 values for radionuclides, radiation level limit, quality control requirements prior to each shipment, approval of special form radioactive materials
- Carriage by Public Highway **49 CFR 177.816, 49 CFR 177.817, 49 CFR 177.834(a), 49 CFR 177.842**: Driver training, shipping paper, general requirements (secured against movement), Class 7 (radioactive) material

Minimum Required Packaging For Class 7 (Radioactive) Materials				
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Quantity:	< 70 Bq/g (< 0.002 µCi/g)	Limited Quantity (§173.421)	A ₁ /A ₂ value (§173.435)	1 rem/hr at 3 m, un-shielded (§173.427)
Non-LSA/SCO:	Excepted	Type A	Type B ³	
Domestic or International LSA/SCO: • LSA-I solid, (liquid) ¹ • SCO-I	Excepted	IP-I	Type B ³	
• LSA-I Liquid • LSA-II Solid, (liquid or gas) ¹ • (LSA-III) ¹ • SCO-II		IP-II	Type B ³	
• LSA-II Liquid or Gas • LSA-III		IP-III	Type B ³	
Domestic (only) LSA/SCO: • LSA-I, II, III; SCO-I, II	Excepted	Strong-tight ²	DOT Spec. 7A Type A	Type B ³ NRC Type A LSA ^{3,4}

1. For entries in parentheses, exclusive use is required for shipment in an IP (e.g., shipment of LSA-I liquid in an IP-I packaging would require exclusive-use consignment)
2. Exclusive use required for strong-tight container shipments made pursuant to §173.427(b)(2)
3. Subject to conditions in Certificate, if NRC package
4. Exclusive use required, see §173.427(b)(4). Use of these packages expires on 4/1/99 (10 CFR 71.52)

Package and Vehicle Radiation Level Limits (49 CFR 173.441) ^A				
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Transport Vehicle Use:	Non-Exclusive	Exclusive		
Transport Vehicle Type:	Open or Closed	Open (flat-bed)	Open w/Enclosure ^B	Closed
Package (or freight container) Limits:				
External Surface	2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	10 mSv/hr (1000 mrem/hr)	10 mSv/hr (1000 mrem/hr)
Transport Index (TI) ^C	10	no limit		
Roadway or Railway Vehicle (or freight container) Limits:				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr (200 mrem/hr)
Vertical planes projected from outer edges		2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	N/A
Top of ...		load: (200 mrem/hr)	enclosure: 2 mSv/hr (200 mrem/hr)	vehicle: 2 mSv/hr (200 mrem/hr)
2 meters from, ...		vertical planes: 0.1 mSv/hr (10 mrem/hr)	vertical planes: 0.1 mSv/hr (10 mrem/hr)	outer lateral surfaces: 0.1 mSv/hr (10 mrem/hr)
Underside		2 mSv/hr (200 mrem/hr)		
Occupied position	N/A ^D	0.02 mSv/hr (2 mrem/hr) ^E		
Sum of package TI's	50	no limit ^F		

- The limits in this table do not apply to excepted packages - see 49 CFR 173.421-426.
- Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures.
- For nonfissile radioactive materials packages, the dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour.
- No dose limit is specified, but separation distances apply to Radioactive Yellow-II or Radioactive Yellow-III labeled packages.
- This does not apply to private carrier wearing dosimetry if under radiation protection program satisfying 10 CFR 20 or 49 CFR 172 Subpart I.
- Some fissile shipments may have combined conveyance TI limit of 100 - see 10 CFR 71.59 and 49 CFR 173.457.

Hazard Communications for Class 7 (Radioactive) Materials

DOT Shipping Papers (49 CFR 172.200-205)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Entries Always Required Unless Excepted	Additional Entries Sometimes Required	Optional Entries
<ul style="list-style-type: none"> The basic description, in sequence: <ul style="list-style-type: none"> Proper Shipping Name, Hazard Class (7), U.N. Identification Number 24 hour emergency response telephone number Name of shipper Proper page numbering (Page 1 of 4) Except for empty and bulk packages, the total quantity (mass, or volume for liquid), in appropriate units (lbs, mL....) If not special form, chemical and physical form The name of each radionuclide (95 percent rule) and total package activity. The activity must be in SI units (e.g., Bq, TBq), or both SI units and customary units (e.g., Ci, mCi). However, for <u>domestic shipments</u>, the activity <i>may</i> be expressed in terms of customary units only, until 4/1/97. For each labeled package: <ul style="list-style-type: none"> The category of label used; The transport index of each package with a Yellow-II or Yellow-III label Shipper's certification (not required of private carriers) 	<p>Materials-Based Requirements</p> <ul style="list-style-type: none"> If hazardous substance, "RQ" as part of the basic description The LSA or SCO group (e.g., LSA-II) "Highway Route Controlled Quantity" as part of the basic description, if HRCQ Fissile material information (e.g., "Fissile Exempt," controlled shipment statement [see §172.203(d)(7)]) If the material is considered hazardous waste and the word waste does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive Material, nos, UN2982) "Radioactive Material" if not in proper shipping name <p>Package-Based Requirements</p> <ul style="list-style-type: none"> Package identification for DOT Type B or NRC certified packages IAEA CoC ID number for export shipments or shipments using foreign-made packaging (see §173.473) <p>Administrative-Based Requirements</p> <ul style="list-style-type: none"> "Exclusive Use-Shipment" Instructions for maintenance of exclusive use-shipment controls for LSA/SCO strong-tight or NRC certified LSA (§ 173.427) If a DOT exemption is being used, "DOT-E" followed by the exemption number 	<ul style="list-style-type: none"> The type of packaging (e.g., Type A, Type B, IP-1,) The technical/chemical name may be included (if listed in §172.203(k), in parentheses between the proper shipping name and hazard class; otherwise inserted in parenthesis after the basic description) Other information is permitted (e.g., functional description of the product), provided it does not confuse or detract from the proper shipping name or other required information For fissile radionuclides, except Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may be used <i>in place of</i> activity units. For Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may optionally be entered <i>in addition to</i> activity units [see §172.203(d)(4)] Emergency response hazards and guidance information (§§172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers [§172.602(b)]


Some Special Considerations/Exceptions for Shipping Paper Requirements

- Shipments of Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste (40 CFR 262).
- Shipping papers must be in the pocket on the left door, or readily visible to a person entering the driver's compartment and within arm's reach of the driver.
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, or be highlighted in a contrasting color.

Hazard Communications for Class 7 (Radioactive) Materials

Marking Packages (49 CFR 172.300-338)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Markings Always Required Unless Excepted	Additional Markings Sometimes Required	Optional Markings
Non-Bulk Packages <ul style="list-style-type: none"> Proper shipping name U.N. identification number Name and address of consignor or consignee, <i>unless</i>: <ul style="list-style-type: none"> 1. highway only and no motor carrier transfers; or part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [see §172.301(d)] 	Materials-Based Requirements <ul style="list-style-type: none"> If in excess of 110 lbs (50 kg), Gross Weight If non-bulk <i>liquid</i> package, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking]  If a Hazardous substance in non-bulk package, the letters "RQ" in association with the proper shipping name Package-Based Requirements <ul style="list-style-type: none"> The package type if Type A or Type B (½" or greater letters) The specification-required markings [e.g., for Spec. 7A packages: "DOT 7A Type A" and "Radioactive Material" (see §178.350-353)] For approved packages, the certificate ID number (e.g., USA/9166/B(U), USA/9150/B(U)-85, ...) If Type B, the trefoil (radiation) symbol per Part 172 App. B [size: outer radius ≥ 20 mm (0.8 in)] For NRC certified packages, the model number, gross weight, and package ID number (10 CFR 71.85) Administrative-Based Requirements <ul style="list-style-type: none"> If a DOT exemption is being used, "DOT-E" followed by the exemption number If an export shipment, "USA" in conjunction with the specification markings or certificate markings 	<ul style="list-style-type: none"> "IP-1," "IP-2," or "IP-3" on industrial packaging is recommended Both the name and address of consignor and consignee are recommended Other markings (e.g., advertising) are permitted, but must be sufficiently away from required markings and labeling
Bulk Packages (i.e., net capacity greater than 119 gallons as a receptacle for liquid, or 119 gallons and 882 pounds as a receptacle for solid, or water capacity greater than 1000 lbs, with no consideration of intermediate forms of containment) <ul style="list-style-type: none"> U.N. identification number, on orange, rectangular panel (see §172.332) - some exceptions exist 		

Some Special Considerations/Exceptions for Marking Requirements

- Marking is required to be: (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package.
- Limited Quantity (§173.421) packages and Articles Containing Natural Uranium and Thorium (§173.426) must bear the marking "radioactive" on the outside of the inner package or the outer package itself, and are excepted from other marking. The excepted packages shipped under UN 2910 must also have the accompanying statement that is required by §173.422.
- Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking.
- Shipment of LSA or SCO required by §173.427 to be consigned as exclusive use are excepted from marking except that the exterior of each nonbulk package must be marked "Radioactive-LSA" or "Radioactive-SCO," as appropriate. Examples of this category are domestic, strong-tight containers with less than an A₂ quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52.
- For bulk packages, marking may be required on more than one side of the package (see 49 CFR 172.302(a)).

Hazard Communications for Class 7 (Radioactive) Materials





Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Placement of Radioactive Labels

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface (not the bottom), (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package.
- For labeling of radioactive materials packages, two labels are required on opposite sides excluding the bottom.

Determination of Required Label

Size: Sides: ≥ 100 mm (3.9 in.) Border: 5-6.3 mm (0.2-0.25 in.)	 49 CFR 172.436	 49 CFR 172.438	 49 CFR 172.440	 49 CFR 172.450
Label	WHITE-I	YELLOW-II	YELLOW-III	EMPTY LABEL
Required when:	Surface radiation level < 0.005 mSv/hr (0.5 mrem/hr)	0.005 mSv/hr (0.5 mrem/hr) < surface radiation level \leq 0.5 mSv/hr (50 mrem/hr)	0.5 mSv/hr (50 mrem/hr) < surface radiation level \leq 2 mSv/hr (200 mrem/h) [Note: 10 mSv/hr (1000 mrem/hr) for exclusive-use closed vehicle (§ 173.441(b))]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to §173.428. It must cover any previous labels, or they must be removed or obliterated.
Or:	TI = 0 [1 meter dose rate < 0.0005 mSv/hr (0.05 mrem/hr)]	TI \leq 1 [1 meter dose rate < 0.01 mSv/hr (1 mrem/hr)]	TI \leq 10 [1 meter dose rate < 0.1 mSv/hr (10 mrem/hr)] [Note: There is no package TI limit for exclusive-use]	
Notes:	<ul style="list-style-type: none"> Any package containing a Highway Route Controlled Quantity (HRCQ) must bear YELLOW-III label Although radiation level transport indices (TIs) are shown above, for fissile material, the TI is typically determined on the basis of criticality control 			

Content on Radioactive Labels

- RADIOACTIVE Label must contain (entered using a durable, weather-resistant means):
 - The radionuclides in the package (with consideration of available space). Symbols (e.g., Co-60) are acceptable.
 - The activity in SI units (e.g., Bq, TBq), or both SI units with customary units (e.g., Ci, mCi) in parenthesis. However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97.
 - The Transport Index (TI) in the supplied box. The TI is entered *only* on YELLOW-II and YELLOW-III labels.

Some Special Considerations/Exceptions for Labeling Requirements

- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, and must not display the hazard class number.
- Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from labeling. However, if the excepted quantity meets the definition for another hazard class, it is re-classed for that hazard. Hazard communication requirements for the other class are required.
- Labeling exceptions exist for shipment of LSA or SCO required by § 173.427 to be consigned as exclusive use.
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§ 172.402(c)].

Hazard Communications for Class 7 (Radioactive) Materials

Placarding Vehicles (49 CFR 172.500-560)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.




Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
 - On four sides of the vehicle;
 - Visible from the direction they face, (for the front side of trucks, tractor-front, trailer, or both are authorized);
 - Clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins);
 - At least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness;
 - Upright and on-point such that the words read horizontally;
 - In contrast with the background, or have a lined-border which contrasts with the background;
 - Such that dirt or water from the transport vehicle's wheels will not strike them;
 - Securely attached or affixed to the vehicle, or in a holder.
- Placard must be maintained by carrier to keep color, legibility, and visibility.

Conditions Requiring Placarding

- Placards are required for any vehicle containing a package with a RADIOACTIVE Yellow-III label.
- Placards are required for shipment of LSA or SCO required by §173.427 to be consigned as exclusive use. Examples of this category are domestic, strong-tight containers with less than an A₂ quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52. Also, for bulk packages of these materials, the orange panel marking with the UN Identification number is not required.
- Placards are required for any vehicle containing a package with a Highway Route Controlled Quantity (HRCQ). In this case, the placard must be placed in a square background as shown below (see §173.507(a)).

Radioactive Placard

<p>Size Specs:</p> <p><i>Sides:</i> ≥ 273 mm (10.8 in.)</p> <p><i>Solid line Inner border:</i> About 12.7 mm (0.5 in.) from edges</p> <p><i>Lettering:</i> ≥ 41 mm (1.6 in.)</p> <p><i>Square for HRCQ:</i> 387mm (15.25 in.) outside length by 25.4 mm (1 in.) thick</p>	 <p>49 CFR 172.556</p> <p>RADIOACTIVE PLACARD (Domestic)</p> <p><i>Base of yellow solid area:</i> 29 ± 5 mm (1.1 ± 0.2 in.) above horizontal centerline</p>	 <p>IAEA SS 6 (1985) paras. 443-444</p> <p>RADIOACTIVE PLACARD (International)</p>	 <p>See 49 CFR 172.527 AND 556</p> <p>RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY (either domestic or international placard could be in middle)</p>
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Some Special Considerations/Exceptions for Placarding Requirements

- Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials. However, some import shipments may have this substitution in accordance with international regulations.
- Bulk packages require the orange, rectangular panel marking containing the UN ID number, which must be placed adjacent to the placard (see §172.332) [NOTE: except for LSA/ SCO exclusive use under §173.427, as above].
- If placarding for more than one hazard class, subsidiary placards must not display the hazard class number. Uranium Hexafluoride (UF₆) shipments ≥ 454 kg (1001 lbs) require both RADIOACTIVE and CORROSIVE (Class 8) placarding.
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE – YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera).

Package and Vehicle Contamination Limits (49 CFR 173.443)

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm²
Sufficient measurements must be taken in the appropriate locations to yield representative assessments

$\beta\gamma$ means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters
* means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters)

*The Basic Contamination Limits
for All Packages:
49 CFR 173.443(a), Table 11*

General Requirement: Non-fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)

$\beta\gamma$: 0.4 Bq/cm² = 40 Bq/100 cm² = 1×10^{-5} μ Ci/cm² = 2200 dpm/100 cm²

α : 0.04 Bq/cm² = 4 Bq/100 cm² = 1×10^{-6} μ Ci/cm² = 220 dpm/100 cm²

The following exceptions and deviations from the above basic limits exist:

Deviation from Basic Limits	Regulation 49 CFR §§	Applicable Location and Conditions Which must Be Met:
10 times the basic limits	173.443(b) and 173.443(c) Also see 177.843 (highway)	On any external surface of a package in an exclusive use shipment, during transport including end of transport. Conditions include: <ul style="list-style-type: none"> Contamination levels at beginning of transport must be below the basic limits. Vehicle must not be returned to service until radiation level is shown to be \leq 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.
10 times the basic limits	173.443(d) Also see 177.843 (highway)	On any external surface of a package, at the beginning or end of transport, if a closed transport vehicle is used, solely for transporting radioactive materials packages. Conditions include: <ul style="list-style-type: none"> A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft). Exterior of vehicle must be conspicuously stenciled, "For Radioactive Materials Use Only" in letters at least 76 mm (3 inches) high, on both sides. Vehicle must be kept closed except when loading and unloading.
100 times the basic limits	173.428	Internal contamination limit for excepted package-empty packaging, Class 7 (Radioactive) Material, shipped in accordance with 49 CFR 173.428. Conditions include: <ol style="list-style-type: none"> The basic contamination limits (above) apply to external surfaces of package. Radiation level must be \leq 0.005 mSv/hr (0.5 mrem/hr) at any external surface. Notice in §173.422(a)(4) must accompany shipment. Package is in unimpaired condition & securely closed to prevent leakage. Labels are removed, obliterated, or covered, and the "empty" label (§172.450) is affixed to the package.

In addition, after any incident involving spillage, breakage, or suspected contamination, the modal-specific DOT regulations (§177.861(a), highway; §174.750(a), railway; and §175.700(b), air) specify that vehicles, buildings, areas, or equipment have "no significant removable surface contamination" before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after incident.

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

Appendix K

Shipper No. _____

Carrier No. _____

Page 1 of 1

(Name of carrier)

(SCAC)

Date _____

TO: Builders, Inc. ** <small>Consignee</small> <small>On Collect on Delivery shipments, the letters "COD" must appear before consignee's name or an otherwise provided in Item 430, Sec. 1.</small>		FROM: Moisture Density Measurements, Inc. ** <small>Shipper</small>	
Street 5678 Jefferson Davis Highway **		Street 1234 A Street, NW **	
Destination Arlington, VA**		Origin Washington, DC 20000**	
Zip Code 22222**			

Route		Vehicle Number				
No. of Units & Container Type	HM		BASIC DESCRIPTION <small>Proper Shipping Name, Hazard Class, Identification Number (UN or NA), per 172.101-172.202</small>	TOTAL QUANTITY <small>(Weight, Volume, Gallons, etc.)</small>	WEIGHT <small>(divided to Conversion)</small>	CHARGES <small>(For Carrier Use Only)</small>
1	RQ		Radioactive material, special form			
			n.o.s. 7 UN2974			
			0.41GBq (11 mCi) Cs-137 and			
			1.9GBq (50 mCi) Am-241:Be	2.31 GBq		
				(61 mCi)		
			RADIOACTIVE - YELLOW II			
			TI = 0.4 **			
			USDOT 7A TYPE A			
			Emergency Response Telephone No.: 1-800-000-0000 (24 hr/d)**			
			** SUBSTITUTE APPROPRIATE INFORMATION FOR			
			YOUR GAUGE AND YOUR SHIPMENT			

PLACARDS TENDERED: YES ☐ NO ☐

<small>Make - where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.</small> <small>The agreed or declared value of the property is hereby specifically stated by the shipper to be the following:</small> \$ _____ per _____	<small>I hereby declare that the contents of the description are fully and accurately described above by proper shipping name and are marked, packaged, marked and labeled, and are in all respects in proper condition for transport by rail - highway - water - air - collectible NON-APPLICABLE BOOK OF TRANSPORTATION according to applicable transportation and national governmental regulations.</small> <i>John Jones</i> Signature	COD AM: \$ _____ <small>Delivered to Recipient 7 of the conditions, if the shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:</small> <small>The consignor shall not make delivery of this shipment without payment of freight and all other bills charged.</small> Signature of Consignor: _____	C.O.D. FEE: PREPAID <input type="checkbox"/> COLLECT <input type="checkbox"/> \$ _____ TOTAL CHARGES: \$ _____ FREIGHT CHARGES: FREIGHT PREPAID <input type="checkbox"/> Freight when bill is paid <input type="checkbox"/> Check for a proper bill to be collected
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RECEIVED: Subject to the regulations and liability limit, bills in effect on the date of the receipt of this bill of lading, the property described above in appropriate good order, except as noted otherwise, and condition of contents of packages (unless marked, contained, and delivered as indicated above which shall carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agree to carry to its usual place of delivery at their expense, if on all route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of

and route to destination and as to each party at any time hereafter in all or any said property that every bill-of-lading to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing tariff or on the date of shipment.
Shipment hereby delivered (that no is further with all the bill of lading terms and conditions in the governing tariff or on the date of shipment and the said terms and conditions are hereby agreed to by the shipper and accepted for receipt and the package)

SHIPPER	CARRIER
PER	PER
	DATE

Permanent post office address of shipper:

STYLE P85 LABELMASTER Div. of 7-manen Labelmark Co., Chicago, IL 60648 312/478-0900

APPENDIX L

Certificate of Disposition of Materials

To access this form please go to
<http://dhfs.wisconsin.gov/forms/DPH/dph45007.pdf>